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CLEAN SITES ENVIRONMENTAL SERVICES INC

January 7, 2002

Ms. Debra Rossi
Remedial Project Manager
Hazardous Substance Cleanup Division
U.S. Environmental Protection Agency
Region III (3HS23)
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Re: Maryland Sand, Gravel and Stone Site
Remediation Technology Screening Technical Memorandum (Revised), and Ground Water Biodegradation Screening Investigation (Revised)

Dear Ms. Rossi:

On behalf of the Settling PRPs, please find enclosed the ***Remediation Technology Screening Technical Memorandum (Rev: 4 Jan 02)*** and, the ***Ground Water Biodegradation Screening Investigation Technical Memorandum (Rev: 4 Jan 02).***

These documents have been revised to incorporate U.S. Environmental Protection Agency (EPA) and Maryland Department of the Environment (MDE) comments dated August 6, 2001, August 15, 2001, and November 27, 2001.

Should you have any questions, please do not hesitate to contact me at 703-519-2135.

Sincerely yours,

Douglas C. Ammon

Douglas C. Ammon, PE

Enclosure

cc: David Healy-MDE
Technical Committee
Neil Peters, ERM

ENVIRONMENTAL RESOURCES MANAGEMENT

REPORT

Maryland Sand, Gravel, and Stone
Ground Water Biodegradation Screening Investigation

Technical Memorandum

15 June 2001

Revised 4 January 2002

48410.23.01

Environmental Resources Management
2666 Riva Road, Suite 200
Annapolis, Maryland 21401

ERM®

REPORT

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1.0 INTRODUCTION

The primary objective of the investigation of natural attenuation at the MSG&S site was to collect sufficient data to evaluate the natural degradation of organic constituents in the Upper Sand ground water unit. A variety of physical, chemical and biological mass transfer processes in aquifers, including dispersion, sorption, volatilization and biodegradation, affect the rate and degree to which organic compounds are naturally attenuated. Data from the investigation was used to provide an initial screening evaluation of the extent to which natural processes are resulting in the degradation of organic compounds in ground water at this site.

This screening investigation was a means to determine whether enhanced biodegradation is a viable technology to be considered as a component of remedial alternatives during the Focused Feasibility Study (FFS) being prepared for the MSG&S site. For enhanced biodegradation to be a viable remedial alternative, it must be shown that the biodegradation, along with other attenuative processes, could be sufficient to achieve the required objectives and schedules stipulated in the FFS, likely in concert with one or more active remedial measures.

Over the past several years the role of biodegradation, and other natural processes, in reducing concentrations of chlorinated hydrocarbons in ground water, has been increasingly recognized and quantified. The natural degradation of chlorinated organic compounds can be evaluated and quantified using standard protocols approved by the U.S. Environmental Protection Agency (EPA). The Technical Protocol for the Evaluation of Chlorinated Solvents in Ground water was originally developed by the Air Force Center For Environmental Excellence at Brooks Air Force Base in San Antonio, Texas (AFCEE Protocols, Wiedemeier et al, 1996). This protocol was subsequently adopted by EPA, with some changes, as an EPA guidance document entitled, Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground water (USEPA, 1998a). Subsequent to this guidance document, EPA issued final EPA Office of Solid waste and Emergency Response (OSWER) Directive 9200.4-17P (USEPA, 1999) which stated that "three lines of evidence" can be used to evaluate natural attenuation of chlorinated aliphatic hydrocarbons, including:

(1) *"Historical ground water and/or soil chemistry data that demonstrate a clear and meaningful trend of decreasing constituent mass and/or concentration over time at appropriate monitoring or sampling points. (In the case of a*

dissolved ground water plume, decreasing concentration will not be solely the result of plume migration. In the case of inorganic constituents, the primary attenuating mechanism will also be understood.)

(2) *Hydrogeologic and geochemical data that can be used to demonstrate indirectly the type(s) of natural attenuation processes active at the site, and the rate at which such processes will reduce constituent concentrations to required levels. For example, characterization data may be used to quantify the rates of constituent sorption, dilution, or volatilization, or to demonstrate and quantify the rates of biological degradation processes occurring at the site.*

(3) *Data from field or microcosm studies (conducted in or with actual contaminated site media) which directly demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the constituents of concern (typically used to demonstrate biological degradation processes only)."*

The OSWER Directive also provides the following guidance on interpreting the lines of evidence (USEPA, 1999):

"Unless EPA or the implementing state agency determines that historical data (Number 1 above) are of sufficient quality and duration to support a decision to use monitored natural attenuation, EPA expects that data characterizing the nature and rates of natural attenuation processes at the site (Number 2 above) will be provided. Where the latter are also inadequate or inconclusive, data from microcosm studies (Number 3 above) may also be necessary."

Typically, the first two "lines of evidence" can be established from the existing (and proposed) data and these two "lines of evidence" are sufficient to provide the basis to reasonably conclude that active biodegradation processes (including reductive dechlorination) are occurring.

There are several important processes at work in the subsurface, including sorption, dispersion, dilution and degradation, but the pertinent process for this discussion is biologically-induced degradation (biodegradation), and more specifically, reductive dechlorination. During dechlorination of chlorinated organic compounds, concentrations of the parent compounds decrease and the daughter products of the process increase in concentration over time. Eventually, the daughter products also decrease as they are further dechlorinated. The final end products of the dechlorination process are carbon dioxide and chloride ions (under aerobic conditions) and ethene and ethane (under anaerobic conditions). There are also important anaerobic biological process that can oxidize cis-1,2-dichloroethene and vinyl chloride to carbon dioxide. Carbon dioxide is often the most important end product under iron and manganese reducing conditions, with little production or accumulation of ethene or ethane.

1.1 *INITIAL GEOCHEMICAL SCREENING*

Ground water quality data collected during previous investigations at the site have shown that byproducts of the biodegradation of chlorinated organic compounds are present in site ground water. Specifically, the presence of 1,2-dichoroethene (DCE), vinyl chloride, and other "daughter" products confirms that some level of dechlorination is occurring at the site. In order to evaluate the degree to which this is occurring, an initial screening of natural attenuation potential at the MS&G site was conducted using the AFCEE screening protocol outlined in the EPA guidance (EPA, 1998). The screening protocol called for the collection and analysis of ground water samples from different areas of the site, including: (1) source area(s), downgradient of source but within the dissolved contaminant plume, (3) downgradient from the dissolved plume, and upgradient/lateral (i.e., background) locations not impacted by the plume. The locations selected for ground water sampling at the MSG&S site are discussed in Section 2.0.

The ground water samples were analyzed for a suite of chemical parameters including volatile organic compounds (VOCs), dissolved gases, selected metals, selected anions, and other properties (e.g., temperature, organic carbon, oxidation-reduction potential (ORP), alkalinity, and pH. The list of parameters analyzed for in the ground water samples is further discussed in Section 2.2.

After the field and laboratory analytical data was assembled, a "score" was assigned for each of the parameters, in accordance with the EPA guidance. Each parameter has a predetermined value in the guidance, and points are only assigned if the data met the specified criteria. The scoring protocol is also present as a simple spreadsheet component of the EPA BIOCHLOR program (EPA, 2001).

The total points awarded for a given ground water sample is reflective of the degree to which anaerobic biodegradation of chlorinated solvents is occurring at that location. AFCEE and EPA have applied the following criteria for use in evaluating the "score" for each ground water sample:

Score	Interpretation(*)
0 to 5	Inadequate evidence for anaerobic degradation of chlorinated organics
6 to 14	Limited evidence for anaerobic degradation of chlorinated organics
15 to 20	Adequate evidence for anaerobic degradation of chlorinated organics
> 20	Strong evidence for anaerobic degradation of chlorinated organics

(*) assumes that the primary degradation pathway is through reductive dechlorination

1.2 *AQUIFER PARAMETERS*

Supplemental to a determination of the degree to which biodegradation is occurring at various locations at the site, it is also important to collect and evaluate hydrogeological data specific to the site. Parameters such as hydraulic gradient, hydraulic conductivity, porosity, dispersivity, and the coefficient of retardation (based on organic carbon content) are critical input parameters for geochemical solute transport models.

To understand and optimize biodegradation, it is important to assess the mechanisms and degradation pathways occurring at the site. It is common to have anaerobic, co-metabolic and aerobic processes dominating in different areas of a site. Delineating these zones is important in understanding the site-specific processes, and in assessing

the rate and completeness of biodegradation. Section 2.2.2 discusses the use of dissolved hydrogen sampling for assessing the degradation pathways at selected wells.

2.0 FIELD METHODS

This section provides information on methods and procedures for the ground water investigation.

2.1 TEMPORARY MONITORING WELL COMPLETION

2.1.1 Well Installation

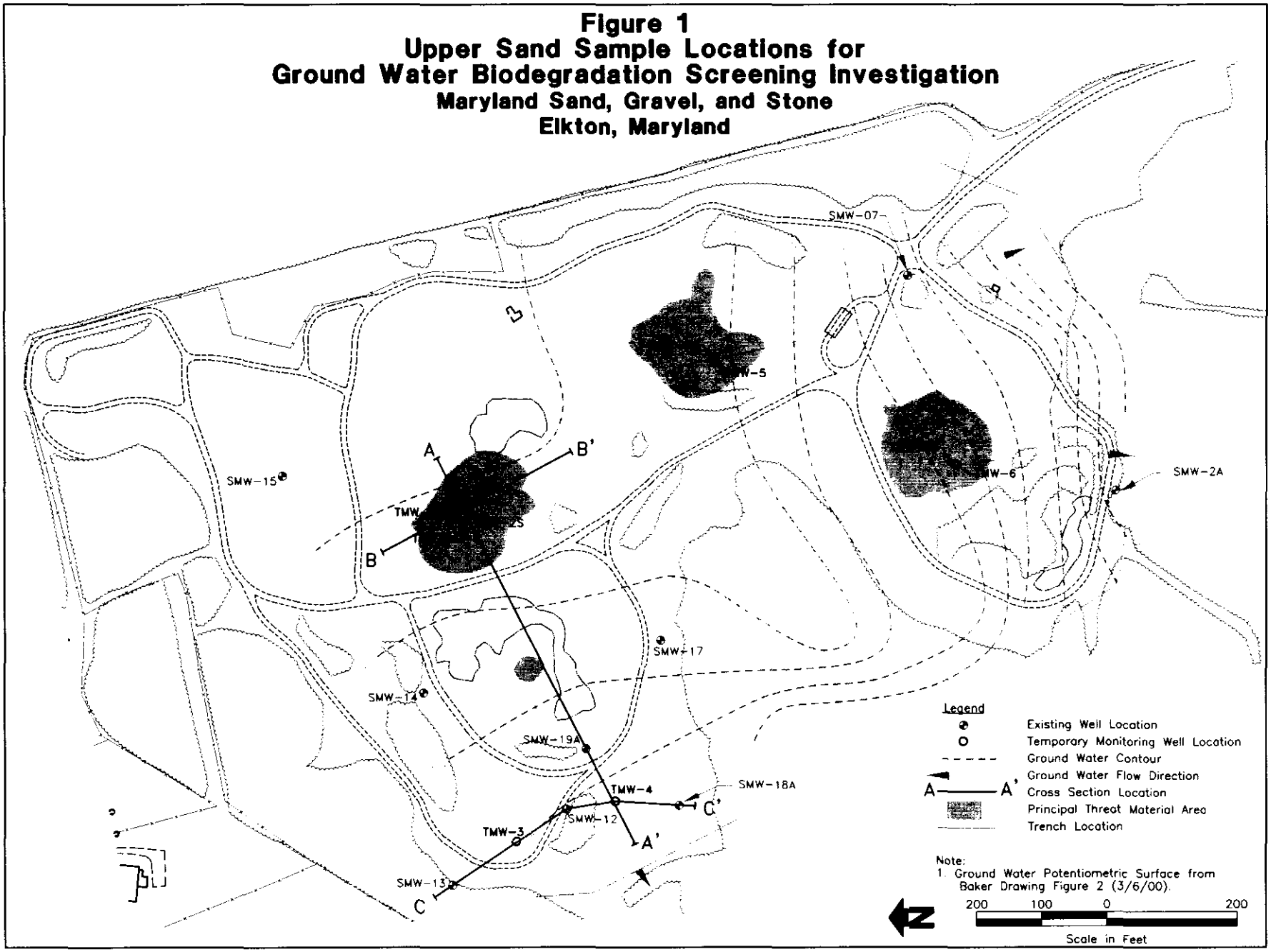
During 13 through 20 March 2001, ERM installed six temporary monitoring wells (TMW-1 through 6) using Geoprobe® direct-push equipment (Figure 1). The well screens were placed on top of the basal clay at the bottom of the Upper Sand and range in depth from 12 to 44 feet below ground surface (bgs). On 18 April 2001, four additional temporary monitoring well (TMW-1S, 2S, 5S and 6S) screens were placed across the water table in the three principal threat areas. The additional wells were installed following review of the deep wells ground water sampling results and FLUTe installations. This data indicated the majority of contamination to be at the water table and in the unsaturated soils. Total depths ranged from 13 to 24 feet bgs. Figures 2A and 2B illustrate the vertical placement of wells along the principal ground water flow path in the Northern Depression Area (NDA). To construct the wells a minimum 2.5-inch Macrocore™ sampler was used to create a borehole in the Upper Sand aquifer. Five foot long, slotted ¾-inch inside diameter, pre-packed well screens were then installed in each borehole to allow for the collection of ground water samples. The temporary wells were constructed with an outer sand filter pack and bentonite seal. Following installation, the wells were developed to remove fine-grained particles from the screened interval. Water generated during purging was processed at the on-site treatment facility in accordance with the project-specific requirements for management of investigation-derived wastes. Well construction logs are presented in Appendix A.

2.1.2 Equipment Decontamination

Drilling and sampling tools (e.g., drilling rods and bits, Macrocore samplers™ etc.) used during well installation were decontaminated between each sample and/or drilling location as appropriate using a non-phosphate soap wash (e.g., Alconox®) followed by a tap water rinse and/or steam cleaning as determined by the field geologist to ensure

ERM, INC.

Figure 1
Upper Sand Sample Locations for Ground Water Biodegradation Screening Investigation
Maryland Sand, Gravel, and Stone
Elkton, Maryland



48410.23.01/06.01.01-MLB/06.04.01-CMP/1101-1A

Figure 2A
Cross Section A-A' with Dissolved VOC Concentrations in Ground Water
April/May 2001
Maryland Sand, Gravel, and Stone
Elkton, Maryland

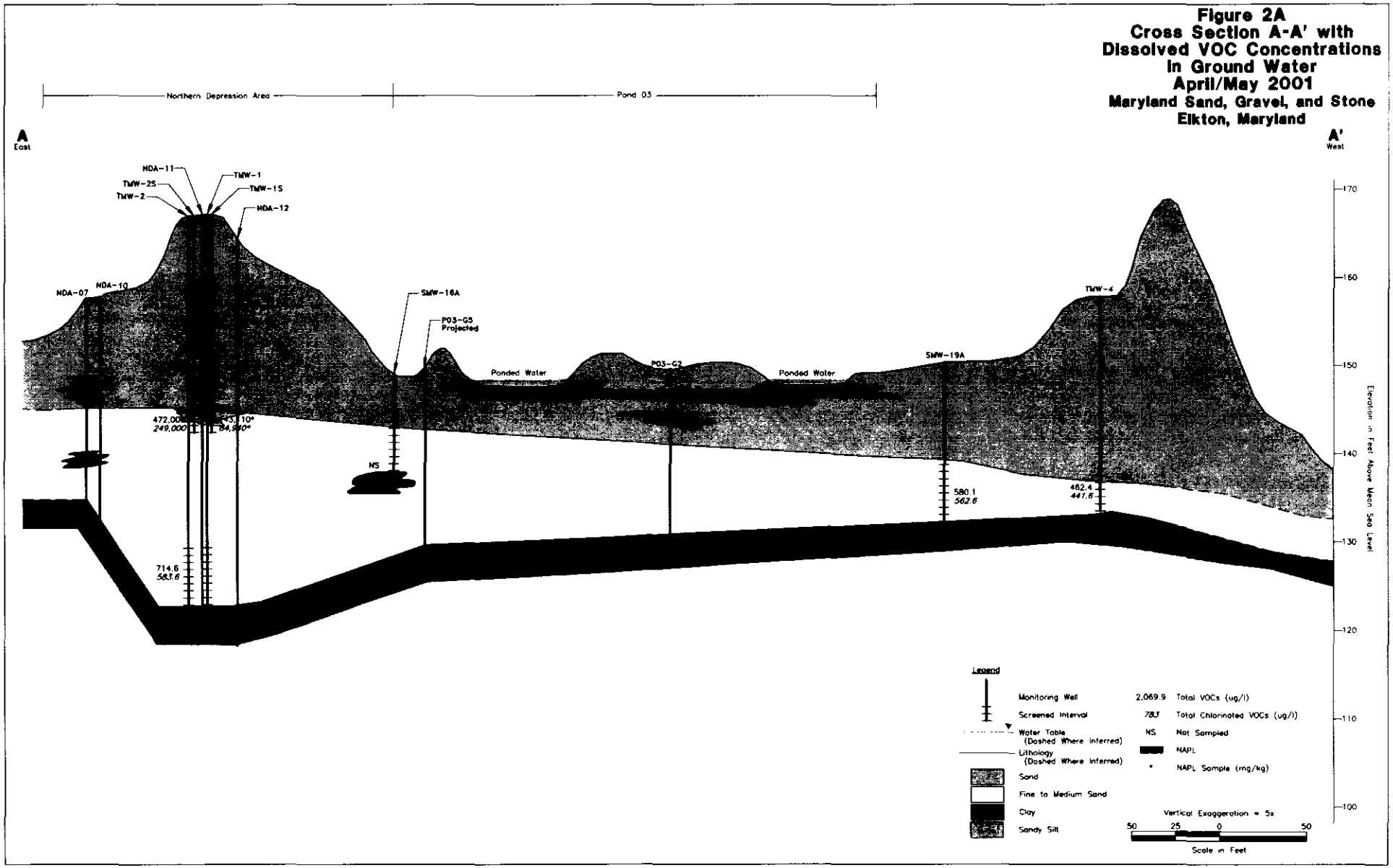
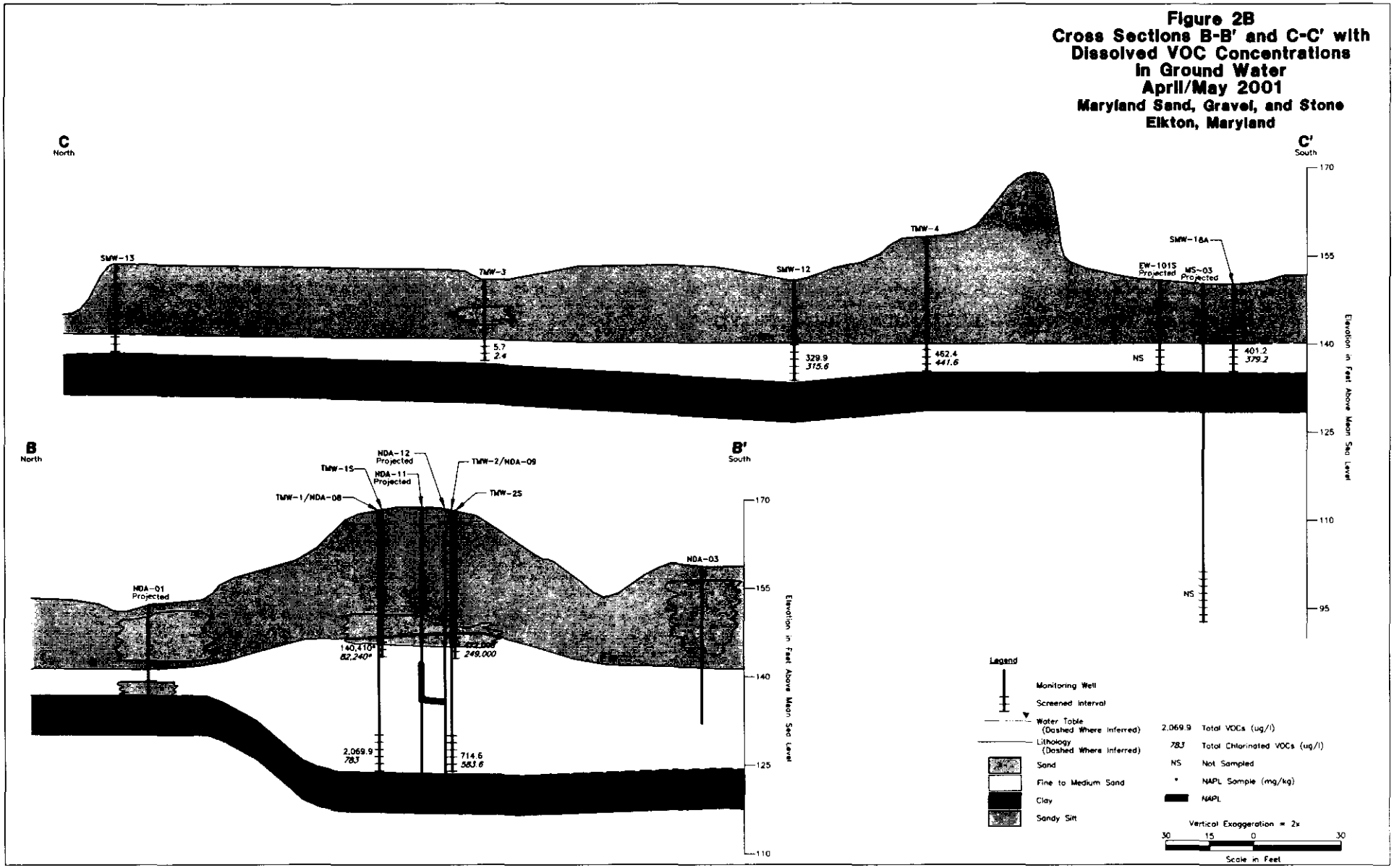


Figure 2B
Cross Sections B-B' and C-C' with Dissolved VOC Concentrations in Ground Water April/May 2001
Maryland Sand, Gravel, and Stone
Elkton, Maryland



adequate cleaning and decontamination of drilling and sampling equipment.

2.2 *GROUND WATER SAMPLING*

Ground water samples were collected from seventeen existing and temporary monitoring wells during 3 through 6 April 2001 and on 24 May 2001 (see Figure 1). Sampling activities were conducted in accordance with the EPA-approved *Ground Water Biodegradation Screening Investigation Work Plan* (ERM, 2001) and 14 March addendum. Samples were collected using a Solinst™ double valve pump (DVP) and clean dedicated polyethylene tubing for each boring. The DVP uses compressed air to lift the sample to the ground surface via a series of check valves (the check valves prevent the air from contacting the ground water sample). SMW-13 and SMW-14 were sampled with a peristaltic pump due to a water column height that was insufficient to fill the DVP chamber. VOC and dissolved permanent gases were collected from the peristaltic pump by allowing the water in the sample line to drain from the tubing intake. This prevented the water from passing through the pump and potentially aerating the samples. A non-aqueous phase liquid (NAPL) was observed in wells TMW-1S and TMW-6S during sampling. A sample of the NAPL from each well was submitted for analysis of VOCs.

Ground water sampling was conducted in accordance with EPA's Region III low-flow sampling methods. When possible, based on existing data or locations of wells relative to potential principal threat areas, the order for sampling wells began with the cleanest well and proceeded to the most contaminated well. Procedures for low-flow sampling are summarized below.

2.2.1 *Low-Flow Sampling Techniques*

Ground water sampling performed using low-flow sampling techniques followed EPA Region III Quality Assurance Directive 23 (QAD023) entitled, *Recommended Procedure for Low-Flow Purging and Sampling of Groundwater Monitoring Wells (EPA, 1999).* These procedures were modified as warranted by field conditions. Low-flow sampling procedures are briefly reiterated below and are described in greater detail in the references identified above. A Solinst™ DVP or peristaltic pump was used for low-flow sampling.

Low-flow refers to the velocity that water enters the pump intake and moves through the formation in the immediate vicinity of the well screen. Water level drawdown at each well was monitored to provide the best indication of the appropriate flow rate for use during sampling. The goal was to achieve flow rates of approximately 100 milliliters per minute, with drawdown during pumping being less than 0.2 foot.

The low-flow pump intake was placed within the screen interval, and used to purge the well until the water quality parameters stabilized within acceptable ranges. The *in-situ* water quality parameters were frequently monitored in the field during pumping, and recorded on field log sheets. These parameters consisted of pH, temperature and specific conductance, as well as dissolved oxygen and ORP, and were measured using an Horiba™ U-22 water quality meter and flow-through cell. CHEMetric's CHEMets test kits were used to field verify the dissolved oxygen concentration in the ground water samples. Drawdown in the well during pumping was also monitored with an electronic water level indicator and recorded during purging.

Once the field-measured water quality parameters stabilized within acceptable tolerances, the ground water sample was collected from the flow of the pump discharge line and discharged directly into the sample bottles. Wells purged with peristaltic pumps were sampled for VOCs and dissolved permanent gases from the well intake line by removing the tubing from the well and allowing the water to drain from the intake (tube bottom) directly into the sample bottles. A HACH™ field kit was used to measure the unfiltered ferrous iron concentration in the field at the time of sampling.

2.2.2 *Dissolved Hydrogen Sampling*

A ground water sample was collected for the analysis of dissolved hydrogen from nine of the 16 selected wells based on the recommended sampling methodology flow rates. Dissolved hydrogen (H_2) is an indicator of microbial activity in ground water, specifically it is an indicator of the type of terminal electron acceptors being utilized by the microorganisms in the aquifer [i.e., methanogenesis (5-20 nanomoles per liter (nM/L), sulfate reduction (1-4 nM/L), iron reduction (0.2-0.8 nM/L), or denitrification (<0.1 nM/L)]. Reductive dechlorination can occur when the dissolved hydrogen concentration is greater than 1 nM/L (USEPA, 1998). The measurement of dissolved hydrogen is a sensitive process due to the highly volatile nature of this gas. Based on the pumping rates required for sampling at the nine wells, ERM followed the hydrogen

sampling protocol developed by Microseeps, Inc., Pittsburgh, Pennsylvania, the laboratory designated to conduct the sample analyses for the biodegradation indicator parameters. The procedure for collection of the ground water samples for hydrogen analyses is a modified version of the "bubble-strip" procedure outlined by Chapelle et al. (1997), and described in the EPA guidance manual (EPA, 1998).

The Microseeps gas stripping cell protocol involved the use of a gas-sampling cell that was provided by the laboratory. The sampling protocol is presented in Appendix A of the approved Work Plan Addendum for this project. The sample vials that were collected for each well were forwarded on to Microseeps for analysis of dissolved hydrogen (Microseeps method AM20GAX).

2.2.3 *Quality Assurance/Quality Control Samples*

Quality assurance/quality control samples consisted of a trip blank for VOC analysis and field duplicates for full analytical analyses. Samples were collected in accordance with the site Quality Assurance Project Plan.

2.2.4 *Decontamination for Ground Water Sampling*

All purging and sampling equipment used at multiple sampling locations was decontaminated prior to use at each location. Purging and sampling equipment was decontaminated using an Alconox non-phosphate soap wash and distilled water rinse. Disposable equipment and supplies (e.g., sample tubing, filters, etc.) were used when appropriate to minimize the potential for cross-contamination. Decontamination fluids were contained and transported to the on site water treatment facility as appropriate for the management of investigation-derived wastes.

2.2.5 *Sample Containers and Preservatives*

Sample containers and preservatives appropriate for the sample media and analyses to be performed were furnished by the analytical laboratory. Each sample container was labeled with an adhesive label that contained the ERM project number, date & time of sample collection, sampler's initials, analyses to be performed, and preservatives (if any).

2.2.6 *Sampling Handling and Chain-of-Custody*

Immediately upon collection, sample containers were placed in coolers chilled to the appropriate temperature with wet ice. Coolers were packed

with sufficient wet ice to ensure the proper temperature was maintained during shipment to the designated laboratory and to prevent damage to sample containers. Liquid samples were also sealed in plastic "ziplock" bags. A chain-of-custody form was completed for each sample shipment. The appropriate copies of the completed chain-of-custody form were placed in a plastic bag and shipped inside the cooler with the samples. All samples contained in the cooler were listed on the chain-of-custody form. A custody seal was placed on each cooler when the cooler was sealed. Sample coolers were delivered to the designated laboratory via Federal Express priority overnight delivery service. Sample chain-of-custody forms are included in Appendix B.

Ground water samples collected for the analysis of VOCs were shipped to STL, Inc. in North Canton, Ohio for analysis. All other parameters were analyzed by Microseeps, Inc., located in Pittsburgh, Pennsylvania.

2.3 *AQUIFER TESTING*

On 10 and 11 May 2001, *in-situ* hydraulic conductivity tests were performed on selected Upper Sand monitoring wells. Field methods for conducting the tests are described below.

In-situ hydraulic conductivity tests were performed on the selected upper sand monitoring wells to provide data for assessing the hydraulic conductivity of the aquifer. Prior to conducting the test in each well, the static water level was measured using an electronic water level indicator. The *in-situ* hydraulic conductivity tests were performed by pumping the well at a particular drawdown.

The tests were conducted as follows (Wilson, Cho, Beck and Vardy, 1997). A 0.25-inch inside diameter polyethylene tube was inserted in the well with the tip at an elevation 0.5-foot (15 cm) below the static water level. A Solinst® peristaltic pump was used to pump water from the tube at a rate that produced both water and air. Depending on the flow rate and observed drawdown in the well the tube was then raised or lowered in three inch increments to achieve the correct water and air mixture. The well was then pumped until the flow rate came to equilibrium and the time to collect 200 mL was measured. If the yield was very slow, the yield in five minutes was measured. Specific capacity was calculated in milliliters per second per centimeter of drawdown. The specific capacity was multiplied by an empirical calibration factor, α, to estimate hydraulic conductivity in centimeters per second (cm/sec).

2.4 *FIELD DOCUMENTATION*

All field activities, notes and observations were documented in a bound weatherproof field book dedicated to the project. Sampling information was recorded on individual field forms which were subsequently stored in the project file.

3.0 GROUND WATER ANALYTICAL RESULTS

The field and laboratory analytical data from the ground water samples was reviewed for completeness and quality control, and summarized in spreadsheets.

3.1 FIELD DATA

Ground water field parameters collected during the low flow purging of the monitoring wells consisted of pH, temperature, specific conductance, dissolved oxygen and ORP. The parameters were measured using an Horiba™ U-22 water quality meter and flow-through cell. Aliquots were also collected for measurement in the field for dissolved oxygen and ferrous iron using field test kits. Table 1 summarizes the field parameters at the time of stabilization and immediately prior to collecting the sample for laboratory analysis. The field test kits were in fairly good agreement with the Horiba™ U-22 meter. The CHEMets dissolved oxygen kit was more accurate for samples with dissolved oxygen concentrations less than 0.5 milligrams per liter (mg/L).

Ground water at the site is slightly acidic with a pH ranging from 4.0 to 6.3; the lowest pH was at the background well SMW-15. The average ground water temperature was 11 Celsius degrees (°C) (or 52 Fahrenheit degrees).

In general, the dissolved oxygen content outside of and on the fringe of the dissolved hydrocarbon plumes was between 6 and 10 mg/L and the ORP was a positive 174 to 335 millivolts (mV), indicating aerobic/oxidizing conditions to be present. On the other hand, ground water within the dissolved hydrocarbon plumes was typically depleted of oxygen and indicated reducing conditions. Some exceptions to this were noted in the NDA area, Pond 02 area and at well SMW-19A. Dissolved oxygen was as high as 5 mg/L in the NDA area deep well TMW-2 and 10 mg/L in the BWA downgradient well SMW-2A. The ORP measurements at SMW-19A were also greater than 200 mV.

Ferrous iron was measured using a HACH field test kit and in the samples provided to the designated laboratory, STL-North Canton, Ohio. The results of the field tests indicated ferrous iron concentrations were greatest where there was anaerobic and reducing conditions.

Table 1. *Stabilized Ground Water Field Parameters*
Maryland Sand, Gravel & Stone, Elkridge, Maryland

Well Identification	Principal Threat Area	Date Sampled	Temporal Parameters						Field Kits	
			pH	Temperature (Degrees C)	Specific Conductance (mS/m)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	ORP (mV)	Dissolved Oxygen (mg/L)	Ferrous Iron (mg/L)
Permanent Monitoring Wells										
SMW-2A	BWA	4/5/2001	5.2	8.06	5	30	10.0	260	10.0	0.4
SMW-07	PO2	4/4/2001	6.3	11.80	45	17	0.6	-91	0.0	>10
SMW-12	NDA	4/4/2001	5.8	9.20	23	46	0.6	-24	0.7	6.4
SMW-13	NDA	4/5/2001	4.9	10.12	9	9	9.6	210	10.0	0.0
SMW-14	NDA	4/6/2001	5.8	10.17	6	1	9.7	174	9.0	0.0
SMW-15	NDA	4/3/2001	4.0	11.70	36	5	6.3	335	6.0	0.0
SMW-17	NDA	4/3/2001	6.1	10.10	44	68	0.7	60	1.0	1.0
SMW-18A	NDA	4/4/2001	4.7	10.40	12	7	6.2	273	7.0	0.6
SMW-19A	NDA	4/4/2001	5.3	10.20	12	66	1.0	209	1.0	1.2
Temporary Monitoring Wells										
TMW-1	NDA	4/6/2001	5.4	8.90	21	210	2.3	-199	2.5	1.6
TMW-1S	NDA	5/24/2001	-	-	-	-	-	-	-	-
TMW-2	NDA	4/6/2001	5.4	11.40	19	320	3.4	-145	5.0	1.5
TMW-2S	NDA	5/24/2001	4.6	12.63	73	90	0.0	26	1.0	4.3
TMW-3	NDA	4/6/2001	4.9	10.31	8	90	6.1	190	6.0	0.6
TMW-4	NDA	4/6/2001	6.0	11.06	16	15	0.6	-128	0.0	7.8
TMW-5	PO2	4/5/2001	5.8	10.99	42	57	0.6	-57	0.0	>10
TMW-5S	PO2	5/24/2001	6.1	13.48	59	644	0.0	-10	0.0	5.6
TMW-6	BWA	4/5/2001	6.0	12.85	45	180	0.5	-66	0.0	>10
TMW-6S	BWA	5/24/2001	4.85	13.99	92	999	-	235	3.0	2.2

Notes:
Temporal Parameters were collected with an Horiba U-22 water quality meter and flow cell.
A Chemets Field Kit was used to verify the dissolved oxygen concentration at the time of sample collection.
A HACH Field Kit was used to determine the ferrous iron concentration at the time of sample collection.
ORP - Oxidation-reduction potential
mS/m - millisiemens per meter
NTU - nepthelometric turbidity units
mg/L - milligrams per liter
mV - millivolts
> - indicates greater than reported value
"-" Not sampled due to NAPL in the well.

3.2 *LABORATORY ANALYTICAL DATA*

The following section discusses the ground water sampling analytical results. The laboratory analytical data is summarized in Table 2. The complete analytical data package from STL-North Canton is included in Appendix B.

3.2.1 *Volatile Organic Compounds*

An upgradient well, SMW-15 was sampled to determine background contaminant levels for the site. All constituents of concern (CoCs) were either non-detect or were detected at levels below 1 microgram per liter (µg/L). Chloroform was detected at 2.2 µg/L.

Northern Depression Area (NDA)

A LNAPL was observed on the water surface at TMW-1S and was subsequently collected for analysis of VOCs and tentatively identified compounds (TICs). The laboratory results confirmed the liquid to be non-aqueous and contained 467 milligrams per kilogram (mg/kg) of chlorinated organics [e.g., 1,1,1-trichloroethane (TCA), tetrachloroethene (PCE), trichloroethene (TCE) and chlorobenzene], 1,370 mg/kg of aliphatic hydrocarbons [e.g., 2-butanone (MEK) and 4-methyl-2-pentanone (MIBK)] and 195 mg/kg of aromatic hydrocarbons (e.g. benzene, toluene and xylenes). NAPL was not observed to be present at TMW-2S. The ground water sample collected from TMW-2S contained 249 mg/L of the same suite of chlorinated organic compounds as the TMW-1S product sample, as well as, 1,1-dichloroethene (1,1-DCE) and a total of 223 mg/L of non-chlorinated hydrocarbons.

Deep wells TMW-1 and TMW-2, located in the NDA source area, contained a similar suite of chlorinated organic compounds as TMW-2S; however the concentrations were two to three orders of magnitude less than the levels reported for TMW-2S. The presence of hydrocarbons in these deeper wells indicates that there is some vertical mixing and degradation within the Upper Sand aquifer.

Several wells downgradient of NDA were sampled to determine the extent of contaminant migration. Several of these wells (SMW-13, SMW-14, and TMW-3) showed only small detections of a limited number of VOCs while others (TMW-3, TMW-4, SMW-12, SMW-17, SMW-18A and SMW-19A) had detections for compounds similar to those in the NDA principal threat area, but at significantly lower (i.e., 3 to 4 orders of

Table 2. *Ground Water Sampling Results*
Maryland Sand, Gravel, and Stone, Elkton, Maryland

Parameter	Units	Northern Depression Area					
		TMW-1S *	TMW-1S-RE1 *	TMW-1	TMW-2S	TMW-2S (Dup)	TMW-2
Volatile Organic Compounds							
1,1,1-Trichloroethane	µg/L	130000	23000000	460	76000	74000	320
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	40	ND	ND	7.1
1,1-Dichloroethene	µg/L	6200 J	ND	ND	ND	ND	3.5
1,2-Dichloroethane	µg/L	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	µg/L	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	2700000	ND	ND	ND	ND
2-Butanone	µg/L	490000	ND	320	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND	ND	ND	ND
4-methyl-2-pentanone	µg/L	670000	5200000	560	62000	61000	21
Acetone	µg/L	210000	ND	170 B	18000 J,B	34000 J,B	37 B
Benzene	µg/L	12000	870000 J	15	ND	ND	3.5
Bromodichloromethane	µg/L	ND	ND	ND	ND	ND	ND
Bromoform	µg/L	ND	ND	ND	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND	ND	ND
Chlorobenzene	µg/L	120000	37000000	170	57000	57000	58
Chloroethane	µg/L	ND	ND	ND	ND	ND	ND
Chloroform	µg/L	25000	940000 J	42	17000 B	19000 B	21
Chloromethane	µg/L	ND	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND
Dibromochloromethane	µg/L	ND	ND	ND	ND	ND	ND
Ethylbenzene	µg/L	ND	2100000	5.9	ND	ND	3.5
Methylene Chloride	µg/L	140000	1600000	ND	39000	43000	45
Styrene	µg/L	ND	ND	ND	ND	ND	ND
Tetrachloroethene	µg/L	26000	16000000	42	17000	17000	58
Toluene	µg/L	160000	38000000	190	120000	120000	49
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND	ND
Trichloroethene	µg/L	20000	ND	29	43000	42000	71
Vinyl Chloride	µg/L	ND	ND	ND	ND	ND	ND
Xylenes (total)	µg/L	23000	12000000	26	23000	22000	17
Wet Chemistry							
Alkalinity as CaCO3	mg/L	–	–	–	–	–	–
Chloride	mg/L	–	–	58	–	–	43
Ferrous Iron	mg/L	–	–	–	–	–	–
Nitrate	mg/L	–	–	8.3	–	–	8.4
Nitrite	mg/L	–	–	0.73	–	–	<0.10
Soluble Organic Carbon	mg/L	–	–	–	–	–	–
Sulfate	mg/L	–	–	4.7	–	–	1.7
Sulfide	mg/L	–	–	–	–	–	–
Total Organic Carbon	mg/L	–	–	–	–	–	–
Metals							
Iron	mg/L	–	–	–	–	–	–
Manganese - dissolved	mg/L	–	–	–	–	–	–
Dissolved Permanent Gases							
Carbon Dioxide	mg/L	–	–	47	–	–	62
Carbon Monoxide	mg/L	–	–	<0.40	–	–	<0.40
Ethane	ng/L	–	–	11000	–	–	1400
Ethene	ng/L	–	–	6000	–	–	800
Hydrogen	nM/L			–	–	–	–
Methane	µg/L	–	–	8.2	–	–	2.1
Nitrogen	mg/L	–	–	17	–	–	18
Oxygen	mg/L	–	–	4	–	–	7.5

ND = Not Detected
B = Analyte was found in an associated method blank
J - Analyte present. Reported value is estimated and may be not be precise.
µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
ng/L - Nanograms per liter.
nM/L - Nanomoles per liter.
– Not analyzed.
* - This sample was collected for VOC fingerprint analysis of NAPL. Results are in units of micrograms per kilogram (µg/kg).

Table 2. *Ground Water Sampling Results*
Maryland Sand, Gravel, and Stone, Elkton, Maryland

Parameter	Units	Northern Depression Area				
		TMW-3	TMW-4	SMW-12	SMW-13	SMW-14
Volatile Organic Compounds						
1,1,1-Trichloroethane	µg/L	1.3	130	84	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND	ND	ND
1,1-Dichloroethane	µg/L	ND	26	70	ND	ND
1,1-Dichloroethene	µg/L	ND	5.5	2.7	ND	ND
1,2-Dichloroethane	µg/L	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	µg/L	ND	17	38	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND
2-Butanone	µg/L	ND	ND	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND	ND	ND
4-methyl-2-pentanone	µg/L	ND	ND	ND	ND	ND
Acetone	µg/L	2.8	16 B	10 B	2.1	ND
Benzene	µg/L	ND	1.3	0.94	ND	ND
Bromodichloromethane	µg/L	ND	ND	ND	ND	ND
Bromoform	µg/L	ND	ND	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND	ND
Chlorobenzene	µg/L	0.44	21	25	0.4	ND
Chloroethane	µg/L	ND	ND	2.9	ND	ND
Chloroform	µg/L	ND	1.9	2	ND	0.31 B
Chloromethane	µg/L	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND
Dibromochloromethane	µg/L	ND	ND	ND	ND	ND
Ethylbenzene	µg/L	ND	ND	0.56	ND	ND
Methylene Chloride	µg/L	ND	2.2	ND	0.38	0.3
Styrene	µg/L	ND	ND	ND	ND	ND
Tetrachloroethene	µg/L	0.42	130	56	ND	ND
Toluene	µg/L	0.37	2.2	1.4	0.13	ND
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND
Trichloroethene	µg/L	0.24	37	22	ND	ND
Vinyl Chloride	µg/L	ND	71	13	ND	ND
Xylenes (total)	µg/L	0.1	1.3	1.4	0.15	ND
Wet Chemistry						
Alkalinity as CaCO3	mg/L	<4	24	50	6	12
Chloride	mg/L	4.1	16	14	3.5	5.6
Ferrous Iron	mg/L	<1	25	10	<1.0	<1.0
Nitrate	mg/L	1.4	0.24	<0.10	0.5	0.42
Nitrite	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Soluble Organic Carbon	mg/L	<2.0	<2.0	<2	7.6	6.2
Sulfate	mg/L	12	16	40	25	8.1
Sulfide	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Total Organic Carbon	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Metals						
Iron	mg/L	0.19	28	14	<0.05	0.074
Manganese - dissolved	mg/L	0.15	0.1	0.2	0.1	0.031
Dissolved Permanent Gases						
Carbon Dioxide	mg/L	120	<0.60	19	28	13
Carbon Monoxide	mg/L	<0.40	–	–	<0.40	–
Ethane	ng/L	210	<5.0	950	110	<5.0
Ethene	ng/L	130	<5.0	1300	92	<5.0
Hydrogen	nM/L	–	1.6	0.69	–	1.7
Methane	µg/L	8.8	0.09	9.4	0.11	0.04
Nitrogen	mg/L	20	17	16	19	15
Oxygen	mg/L	7.5	0.24	5.6	11	7.4

ND = Not Detected
B = Analyte was found in an associated method blank
J - Analyte present. Reported value is estimated and may be not be precise.
µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
ng/L - Nanograms per liter.
nM/L - Nanomoles per liter.
-- Not analyzed.
* - This sample was collected for VOC fingerprint analysis of NAPL. Results are in units of micrograms per kilogram (µg/kg).

Table 2. *Ground Water Sampling Results*
Maryland Sand, Gravel, and Stone, Elkton, Maryland

Parameter	Units	Northern Depression Area				
		SMW-15	SMW-15 (Dup)	SMW-17	SMW-18A	SMW-19A
Volatile Organic Compounds						
1,1,1-Trichloroethane	µg/L	ND	ND	360	260	150
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	5.2	ND	ND
1,1-Dichloroethane	µg/L	ND	ND	180	60	140
1,1-Dichloroethene	µg/L	ND	ND	2.5	3.7	2.4
1,2-Dichloroethane	µg/L	ND	ND	12	3.8	2.5
1,2-Dichloroethene (total)	µg/L	ND	ND	22	8.1	58
1,2-Dichloropropane	µg/L	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND	ND	ND
2-Butanone	µg/L	ND	ND	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND	ND	ND
4-methyl-2-pentanone	µg/L	ND	ND	ND	ND	ND
Acetone	µg/L	ND	ND	ND	22 B	ND
Benzene	µg/L	ND	ND	ND	ND	4.4
Bromodichloromethane	µg/L	ND	ND	ND	ND	ND
Bromoform	µg/L	ND	ND	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND	ND	ND
Chlorobenzene	µg/L	0.18	ND	10	5.1 J	38
Chloroethane	µg/L	ND	ND	5.5	ND	26
Chloroform	µg/L	2.2	2.1 B	7	3.7	3.7
Chloromethane	µg/L	ND	ND	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND
Dibromochloromethane	µg/L	ND	ND	ND	ND	ND
Ethylbenzene	µg/L	ND	ND	25	ND	3.6
Methylene Chloride	µg/L	0.3	0.36 J	ND	ND	7
Styrene	µg/L	ND	ND	ND	ND	ND
Tetrachloroethene	µg/L	0.11	0.11 J	5.5	7.8	87
Toluene	µg/L	0.15	ND	83	ND	5.5
trans-1,3-Dichloropropene	µg/L	ND	ND	ND	ND	ND
Trichloroethene	µg/L	ND	ND	45	27	20
Vinyl Chloride	µg/L	ND	ND	9.6	ND	28
Xylenes (total)	µg/L	ND	ND	93	ND	4
Wet Chemistry						
Alkalinity as CaCO3	mg/L	<4	<4	200	<4	6
Chloride	mg/L	79	78	9.4	5.9	20
Ferrous Iron	mg/L	<1.0	<1.0	1.8	<1	1.6
Nitrate	mg/L	22	22	0.24	3.8	<0.10
Nitrite	mg/L	<0.10	<0.10	<0.10	<0.1	<0.10
Soluble Organic Carbon	mg/L	18	<2.0	11	<2	<2.0
Sulfate	mg/L	20	19	14	36	13
Sulfide	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0
Total Organic Carbon	mg/L	<2.0	<2	2.3	<2.0	<2.0
Metals						
Iron	mg/L	<0.05	<0.05	4.3	0.99	6.5
Manganese - dissolved	mg/L	0.067	0.066	0.77	0.12	0.11
Dissolved Permanent Gases						
Carbon Dioxide	mg/L	70	58	20	62	56
Carbon Monoxide	mg/L	--	--	--	<0.4	<0.4
Ethane	ng/L	<5.0	<5.0	710	170	1800
Ethene	ng/L	<5.0	<5.0	2300	170	63000
Hydrogen	nM/L	1	1.1	4.7	--	--
Methane	µg/L	0.04	0.04	160	1.8	14
Nitrogen	mg/L	15	15	16	21	24
Oxygen	mg/L	6.5	6.1	5.6	9.4	2.6

ND = Not Detected
B = Analyte was found in an associated method blank
J - Analyte present. Reported value is estimated and may be not be precise.
µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
ng/L - Nanograms per liter.
nM/L - Nanomoles per liter.
-- Not analyzed.
* - This sample was collected for VOC fingerprint analysis of NAPL. Results are in units of micrograms per kilogram (µg/kg).

Table 2. *Ground Water Sampling Results*
Maryland Sand, Gravel, and Stone, Elkton, Maryland

Parameter	Units	TMW-5S	Pond 02 TMW-5	SMW-7
Volatile Organic Compounds				
1,1,1-Trichloroethane	µg/L	32000	ND	ND
1,1,2,2-Tetrachloroethane	µg/L	ND	ND	ND
1,1,2-Trichloroethane	µg/L	ND	ND	ND
1,1-Dichloroethane	µg/L	670 J	150	ND
1,1-Dichloroethene	µg/L	ND	ND	ND
1,2-Dichloroethane	µg/L	ND	ND	ND
1,2-Dichloroethene (total)	µg/L	600 J	ND	ND
1,2-Dichloropropane	µg/L	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND
2-Butanone	µg/L	ND	ND	ND
2-Hexanone	µg/L	ND	ND	ND
4-methyl-2-pentanone	µg/L	26000	ND	ND
Acetone	µg/L	7300 J,B	ND	ND
Benzene	µg/L	1700 J	320	450
Bromodichloromethane	µg/L	720 J,B	ND	ND
Bromoform	µg/L	ND	ND	ND
Bromomethane	µg/L	ND	ND	ND
Carbon Disulfide	µg/L	ND	ND	ND
Carbon Tetrachloride	µg/L	ND	ND	ND
Chlorobenzene	µg/L	12000	5400	8600
Chloroethane	µg/L	ND	780	1500
Chloroform	µg/L	2100 J,B	150 B	ND
Chloromethane	µg/L	ND	ND	ND
cis-1,3-Dichloropropene	µg/L	ND	ND	ND
Dibromochloromethane	µg/L	ND	ND	ND
Ethylbenzene	µg/L	1000 J	370	400
Methylene Chloride	µg/L	29000	ND	ND
Styrene	µg/L	ND	ND	ND
Tetrachloroethene	µg/L	7700	ND	ND
Toluene	µg/L	63000	13000	6700
trans-1,3-Dichloropropene	µg/L	ND	ND	ND
Trichloroethene	µg/L	18000	ND	ND
Vinyl Chloride	µg/L	ND	ND	ND
Xylenes (total)	µg/L	5000	1700	1700
Wet Chemistry				
Alkalinity as CaCO3	mg/L	--	110	54
Chloride	mg/L	--	37	40
Ferrous Iron	mg/L	--	88	88
Nitrate	mg/L	--	<0.10	<0.10
Nitrite	mg/L	--	<0.10	<0.10
Soluble Organic Carbon	mg/L	--	30	9.9
Sulfate	mg/L	--	<1.0	<1.0
Sulfide	mg/L	--	<2.0	<2.0
Total Organic Carbon	mg/L	--	30	9.1
Metals				
Iron	mg/L	--	74	71
Manganese - dissolved	mg/L	--	0.34	0.16
Dissolved Permanent Gases				
Carbon Dioxide	mg/L	--	64	38
Carbon Monoxide	mg/L	--	--	--
Ethane	ng/L	--	87000	460000
Ethene	ng/L	--	1100000	210000
Hydrogen	nM/L	--	29	1.4
Methane	µg/L	--	900	2400
Nitrogen	mg/L	--	14	14
Oxygen	mg/L	--	4.5	3.7

ND = Not Detected
B = Analyte was found in an associated method blank
J - Analyte present. Reported value is estimated and may be not be precise.
µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
ng/L - Nanograms per liter.
nM/L - Nanomoles per liter.
-- Not analyzed.
* - This sample was collected for VOC fingerprint analysis of NAPL. Results are in units of micrograms per kilogram (µg/kg).

Table 2. *Ground Water Sampling Results*
Maryland Sand, Gravel, and Stone, Elkton, Maryland

Parameter	Buried Waste Area			
	TMW - 6S *	TMW - 6S-RE1 *	TMW - 6	SMW - 2A
Volatile Organic Compounds				
1,1,1-Trichloroethane	160000	510000	ND	18
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND
1,1,2-Trichloroethane	ND	ND	ND	ND
1,1-Dichloroethane	ND	ND	ND	12
1,1-Dichloroethene	9900 J	ND	ND	1.2
1,2-Dichloroethane	ND	ND	ND	3.2
1,2-Dichloroethene (total)	ND	ND	ND	50
1,2-Dichloropropane	ND	ND	ND	ND
1,4-Dichlorobenzene	µg/L	ND	ND	ND
2-Butanone	31000 J	ND	ND	ND
2-Hexanone	ND	ND	ND	ND
4-methyl-2-pentanone	320000	360000	ND	ND
Acetone	50000	91000 J	ND	5.7 B
Benzene	7200 J	ND	290	ND
Bromodichloromethane	ND	ND	ND	ND
Bromoform	ND	ND	ND	ND
Bromomethane	ND	ND	ND	ND
Carbon Disulfide	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND
Chlorobenzene	65000	360000	3700	0.92
Chloroethane	ND	ND	240	ND
Chloroform	ND	ND	ND	0.55
Chloromethane	ND	ND	ND	ND
cis-1,3-Dichloropropene	ND	ND	ND	ND
Dibromochloromethane	ND	ND	ND	ND
Ethylbenzene	5200 J	40000 J	45	ND
Methylene Chloride	170000	170000	ND	0.77
Styrene	*ND*	*ND*	*ND*	*ND*
Tetrachloroethene	26000	240000	19	26
Toluene	92000	430000	77	ND
trans-1,3-Dichloropropene	ND	ND	ND	ND
Trichloroethene	49000	180000	ND	27
Vinyl Chloride	ND	ND	ND	1.9
Xylenes (total)	32000	230000	310	ND
Wet Chemistry				
Alkalinity as CaCO3	--	--	140	<4.0
Chloride	--	--	27	3
Ferrous Iron	--	--	72	<1.0
Nitrate	--	--	<0.10	<0.10
Nitrite	--	--	<0.10	<0.10
Soluble Organic Carbon	--	--	3.8	6.6
Sulfate	--	--	<1.0	11
Sulfide	--	--	<2.0	<2.0
Total Organic Carbon	--	--	4.2	<2
Metals				
Iron	--	--	57	0.56
Manganese - dissolved	--	--	0.24	0.021
Dissolved Permanent Gases				
Carbon Dioxide	--	--	76	17
Carbon Monoxide	--	--	--	--
Ethane	--	--	250000	210
Ethene	--	--	710	53
Hydrogen	--	--	330	2.5
Methane	--	--	5600	0.14
Nitrogen	--	--	11	15
Oxygen	--	--	3.6	7.1

ND = Not Detected
B = Analyte was found in an associated method blank
J - Analyte present. Reported value is estimated and may be not be precise.
µg/L - Micrograms per liter.
mg/L - Milligrams per liter.
ng/L - Nanograms per liter.
nM/L - Nanomoles per liter.
-- Not analyzed.
* - This sample was collected for VOC fingerprint analysis of NAPL. Results are in units of micrograms per kilogram (µg/kg).

magnitude) concentrations. The presence of vinyl chloride and chloroethane in several of the downgradient wells is attributed to the reductive dechlorination of PCE and TCA along the plume flow path.

Pond 02 Wet Area (Pond 02)

The Pond 02 principal threat area well TMW-5S, had the highest VOC concentrations of the ground water samples. Toluene was the VOC detected with the highest concentration at 63 mg/L. Several chlorinated hydrocarbons were also present at concentrations greater than 10 mg/L including methylene chloride, TCA, TCE and chlorobenzene. 4-methyl-2-pentanone (MIBK) was also present with a concentration of 26 mg/L. Many of the constituents detected in the shallow well were not detected in the nearby deeper well, TMW-5. However, chloroethane, a daughter product of TCA and DCA was present. In general, VOC concentrations were reduced by an order of magnitude in the deeper well relative to the shallow well.

Constituents detected in SMW-7, located downgradient of the PO2 principal threat area, were consistent with those identified in the principal threat source area well (TMW-5). Concentrations of chloroethane (1.5 mg/L) and chlorobenzene (8.6 mg/L), which were the only chlorinated organics identified in the sample, were similar or greater than their corresponding levels in the TMW-5S principal threat area sample. Total BTEX concentrations decreased from 71 mg/L (TMW-5S) to 9 mg/L (SMW-7), hydraulically downgradient of the principal threat area.

Buried Waste Area (BWA)

The laboratory results confirmed the liquid sample collected from the principal threat area well, TMW-6S, to be non-aqueous and containing 480 mg/kg of chlorinated organics (e.g., TCA, PCE, TCE and chlorobenzene), 401 mg/kg of aliphatic hydrocarbons (e.g., MEK and MIBK) and 136 mg/kg of aromatic hydrocarbons. MIBK had the highest concentration at 320 mg/kg. With the exception of chlorobenzene (3.7 mg/L), the suite of constituents present in the NAPL sample from TMW-6S were detected at dissolved concentrations less than 0.5 mg/L in the adjacent deep well TMW-6 ground water sample.

SMW-2A, located downgradient of the BWA source area, was also sampled. Laboratory analysis showed few detections, all of which were at significantly reduced levels relative to TMW-6 and the levels found in the TMW-6S NAPL samples. The highest identified concentration was 0.05

mg/L for 1,2-DCE (total). A trace of vinyl chloride was also found to be present in the downgradient well indicating complete reductive dechlorination of PCE and TCE to be occurring in the BWA. Chlorobenzene was also reduced to trace levels in the downgradient well.

3.2.2 *General Chemistry*

Ground water samples were analyzed for selected anions and intrinsic biodegradation indicator parameters (e.g., dissolved permanent gases, light hydrocarbons, select metals, and organic carbon). The resulting information was then used in the development of a natural attenuation study. A summary of these analytical results is presented in Table 2.

3.3 *AQUIFER TEST RESULTS*

On 10 and 11 May 2001, in-situ hydraulic conductivity tests were performed on selected Upper Sand monitoring wells. Field methods for conducting the tests are described below.

In-situ hydraulic conductivity tests were performed on the selected upper sand monitoring wells to provide data for assessing the hydraulic conductivity of the aquifer. Prior to conducting the test in each well, the static water level was measured using an electronic water level indicator. The *in-situ* hydraulic conductivity tests were performed by pumping the well at a particular drawdown.

The tests were conducted as follows (Wilson, Cho, Beck and Vardy, 1997). A 0.25-inch inside diameter polyethylene tube was inserted in the well with the tip at an elevation 0.5 foot (15 cm) below the static water level. A Solinst® peristaltic pump was used to pump water from the tube at a rate that produced both water and air. Depending on the flow rate and observed drawdown in the well the tube was then raised or lowered in three inch increments to achieve the correct water and air mixture. The well was then pumped until the flow rate came to equilibrium and the time to collect 200 mL was measured. If the yield was very slow, the yield in five minutes was measured. Specific capacity was calculated in milliliters per second per centimeter of drawdown. The specific capacity was multiplied by an empirical calibration factor, α, to estimate hydraulic conductivity in centimeters per second (cm/sec).

The empirical calibration factor α was calculated as follows:

$$\alpha = [1 + \ln (z/2r_w)]/2\pi z$$

where:

z is the screened interval below the water table and

$2r_w$ is the outer diameter of the well borehole.

Reduction and analysis of data collected during the hydraulic conductivity tests was performed using the Wilson, Cho, Beck and Vardy (1997) method for unconfined aquifers. The data collected from the tests was used to estimate the hydraulic conductivity for the Upper Sand aquifer at specific well locations. The hydraulic conductivity values calculated from the tests are presented in Table 3.

As shown in Table 3, the single-well hydraulic conductivity tests conducted by ERM in 2001 are in fairly good agreement with the slug tests performed by AEPCO in 1985. The average (geometric mean) hydraulic conductivity of 6.4×10^{-4} cm/sec (1.8 feet/day) also falls within the 10^{-3} to 10^{-5} cm/sec range published for silty sands (Fetter, 1994; Freeze and Cherry, 1979).

The average linear ground water velocity is the rate at which ground water moves between two points. The average linear velocity of ground water at the site can be calculated using the following equation:

$$v_e = (K_h \times dh/dl) / n_e$$

where:

v_e is the effective ground water velocity (L/T);

K_h is the hydraulic conductivity (L/T);

dh/dl is the hydraulic gradient (dimensionless); and

n_e is the effective porosity (dimensionless).

For example, using site specific values for hydraulic gradient of 0.013, an average hydraulic conductivity of 9×10^{-4} cm/sec (2.6 feet/day), and an estimated effective porosity of 0.36, the average linear ground water

Table 3. *Field Estimates of Hydraulic Conductivity*
Maryland Sand, Gravel & Stone, Elkton, Maryland

Well ID	Well Radius	Borehole Radius	Flow Rate	Drawdown	Water Column	Saturated Screen	Constant	ERM 2001 Field Test (a) Hydraulic Conductivity	
	cm	cm	ml/sec	cm	cm	cm	cm^{-1}	cm/sec	ft/day
Temporary Monitoring Wells									
TMW-1	0.95	2.70	0.42	Dry	720.85	152.40	0.005	NA	NA
TMW-1S	1.26	4.13	2.59	15.24	79.25	79.25	0.007	1.11 E-3	3.15 E+0
TMW-2	0.95	2.70	0.42	Dry	707.14	152.40	0.005	NA	NA
TMW-2S	1.26	4.13	1.22	40.54	122.53	122.53	0.005	1.45 E-4	4.11 E-1
TMW-3	0.95	2.70	0.50	Dry	74.07	74.07	0.008	NA	NA
TMW-4	0.95	2.70	4.48	10.06	238.96	152.40	0.005	2.02 E-3	5.72 E+0
TMW-5	0.95	2.70	3.85	5.06	213.97	152.40	0.005	3.45 E-3	9.77 E+0
TMW-5S	1.26	4.13	2.56	91.44	86.87	86.87	0.006	1.72 E-4	4.89 E-1
TMW-6	0.95	2.70	2.99	8.89	398.37	152.40	0.005	1.52 E-3	4.32 E+0
TMW-6S	1.26	4.13	NA	NA	89.00	89.00	0.006	NA	NA
Existing Monitoring Wells									
SMW-2A	5.03	15.24	0.58	30.48	171.91	171.91	0.003	4.84 E-5	1.37 E-1
SMW-7	5.03	15.24	0.58	15.24	429.16	152.40	0.003	1.05 E-4	2.97 E-1
SMW-12	5.03	15.24	2.32	22.86	216.41	152.40	0.003	2.76 E-4	7.83 E-1
SMW-13	5.03	15.24	NA	NA	24.38	24.38	0.005	NA	NA
SMW-14	5.03	15.24	8.96	7.62	33.53	33.53	0.005	6.11 E-3	1.73 E+1
SMW-15	5.03	15.24	14.29	3.66	384.96	304.80	0.002	6.74 E-3	1.91 E+1
SMW-17	5.03	15.24	1.32	15.24	150.88	150.88	0.003	2.37 E-4	6.73 E-1
SMW-18A	5.03	15.24	13.95	15.24	103.63	103.63	0.003	3.13 E-3	8.87 E+0
SMW-19A	5.03	15.24	0.97	17.77	254.51	152.40	0.003	1.49 E-4	4.22 E-1
Statistics									
Maximum								6.74 E-3	1.91 E+1
Minimum								4.84 E-5	1.37 E-1
Geometric Mean								6.39 E-4	1.81 E+0
Arithmetic Mean								1.80 E-3	5.11 E+0

Notes:
(a) Field estimates of hydraulic conductivity based on method developed by Wilson et al., 1997.
NA - Not available due to excessive water level drawdown.

velocity in the Upper Sand aquifer at the Northern Depression Area is approximately 34 feet/year.

4.0 *DATA EVALUATION*

The data from fifteen locations (water table wells in the principal threat areas were excluded) was entered into the AFCEE scoring table. This scoring served as the initial screening of the extent to which natural biodegradation, through reductive dechlorination, is degrading chlorinated hydrocarbons in the Upper Sand, at each sample location.

4.1 *AFCEE SCORING AND NATURAL ATTENUATION*

The AFCEE screening spreadsheet calculated a relative "score" for each ground water sample analyzed based on the geochemical conditions and presence or absence of daughter products. This allowed for a semi-quantitative assessment of biodegradation of chlorinated organic compounds in different areas of the Upper Sand aquifer. Table 4 contains the AFCEE scoring for selected wells sampled at the site. Figure 3 shows the well locations and the associated AFCEE scoring for each well.

A score of 15 points or greater suggests that there is adequate evidence that biodegradation (via reductive dechlorination) is occurring in the ground water at the location where that sample was collected. A score of 20 or better indicates strong evidence that biodegradation of chlorinated hydrocarbons is occurring. Of the 15 samples screened using the AFCEE scoring, seven indicated that there is adequate to strong evidence that biodegradation is occurring along the main ground water flowpath downgradient of each of the three principal threat areas.

Northern Depression Area (NDA)

The deep wells at NDA, TMW-1 and TMW-2, indicate that there is limited evidence for anaerobic biodegradation within the NDA. The ground water sample collected from temporary well TMW-2S was not included in the AFCEE screening since it was located immediately within the source hot spot, and light-NAPL (LNAPL) was present on the water table at TMW-1S.

Of the eleven remaining monitoring wells tested in this area of the site, extensive and complete dechlorination occurs downgradient near wells SMW-12, SMW-17 and SMW-19A with less complete dechlorination in TMW-4. With the exception of SMW-17, these wells are located along the

Table 4. Natural Attenuation Screening for Selected Monitoring Wells
Maryland Sand, Gravel & Stone, Elkton, Maryland

Natural Attenuation Screening Protocol	Score	Interpretation	NDA TMW-1		NDA TMW-2		NDA TMW-3	
	[redacted]	Inadequate evidence for anaerobic biodegradation* of chlorinated organics						
		Limited evidence for anaerobic biodegradation* of chlorinated organics	Score: [redacted]		Score: [redacted]		Score: [redacted]	
		Adequate evidence for anaerobic biodegradation* of chlorinated organics						
		Strong evidence for anaerobic biodegradation* of chlorinated organics						
Analysis	Concentration in Most Contam. Zone	Interpretation		Points Awarded		Points Awarded		Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	No	0	No	0	No	0
	>5mg/L	Not tolerated; however, VC may be oxidized aerobically	No	0	No	0	Yes	-3
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	No	0	No	0	No	0
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	Yes	3	Yes	3	No	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	Yes	2	Yes	2
Sulfide*	>1 mg/L	Reductive pathway possible	NA	0	NA	0	No	0
Methane*	<0.5 mg/L	VC oxidizes	Yes	0	Yes	0	Yes	0
	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	No	0	No	0	No	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	Yes	1	Yes	1	No	0
	<-100mV	Reductive pathway likely	Yes	2	Yes	2	No	0
pH*	5 < pH < 9	Optimal range for reductive pathway	Yes	0	Yes	0	No	0
	5 > pH >9	Outside optimal range for reductive pathway	No	0	No	0	Yes	-2
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	NA	0	NA	0	No	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	No	0	No	0	No	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	No	0	No	0	No	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	NA	0	NA	0	No	0
Chloride*	>2x background	Daughter product of organic chlorine	No	0	No	0	No	0
Hydrogen	*>1 nM*	*Reductive pathway possible; VC may accumulate*	NA	0	NA	0	NA	0
	<1 nM	VC oxidized	NA	0	NA	0	NA	0
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	Yes	2	No	0	No	0
PCE*		Material released	Yes	0	Yes	0	Yes	0
TCE*		Material released	Yes	0	Yes	0	Yes	0
		Daughter product of PCE a/	No	0	No	0	No	0
DCE*		Material released	No	0	No	0	No	0
		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE a/; 1,1-DCE can be a chem. reaction product of TCA	No	0	No	0	No	0
VC*		Material released	No	0	No	0	No	0
		Daughter product of DCE a/	No	0	No	0	No	0
1,1,1-Trichloroethane*		Material released	Yes	0	Yes	0	Yes	0
DCA		Daughter product of TCA under reducing conditions	Yes	2	Yes	2	No	0
Carbon Tetrachloride		Material released	No	0	No	0	No	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	No	0	No	0	No	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	NA	0	NA	0	NA	0
	>0.1 mg/L	Daughter product of VC/ethene	NA	0	NA	0	NA	0
Chloroform		Material released	Yes	0	Yes	0	No	0
		Daughter product of Carbon Tetrachloride	No	0	No	0	No	0
(Dichloromethane) Methylene Chloride		Material released	Yes	0	Yes	0	No	0
		Daughter product of Chloroform	Yes	2	Yes	2	No	0

Notes:
NA - Not available. Sample not collected
* Required analysis.
a/ Points awarded only if it can be shown that the constituent is a daughter product.

Table 4. ***Natural Attenuation Screening for Selected Monitoring Wells***
Maryland Sand, Gravel & Stone, Elkton, Maryland

Natural Attenuation Screening Protocol	Score	Interpretation	NDA TMW-4		NDA SMW-12		NDA SMW-13	
	[redacted]	Inadequate evidence for anaerobic biodegradation* of chlorinated organics						
		Limited evidence for anaerobic biodegradation* of chlorinated organics	Score: [redacted]		Score: [redacted]		Score: [redacted]	
		Adequate evidence for anaerobic biodegradation* of chlorinated organics						
		Strong evidence for anaerobic biodegradation* of chlorinated organics						
Analysis	Concentration in Most Contam. Zone	Interpretation		Points Awarded		Points Awarded		Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	Yes	3	No	0	No	0
	>5mg/L	Not tolerated; however, VC may be oxidized aerobically	No	0	No	0	Yes	-3
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	Yes	2	Yes	2
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	Yes	3	Yes	3	No	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	No	0	No	0
Sulfide*	>1 mg/L	Reductive pathway possible	No	0	No	0	No	0
Methane*	<0.5 mg/L	VC oxidizes	Yes	0	Yes	0	Yes	0
	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	No	0	No	0	No	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	Yes	1	Yes	1	No	0
	<-100mV	Reductive pathway likely	Yes	2	No	0	No	0
pH*	5 < pH < 9	Optimal range for reductive pathway	Yes	0	Yes	0	No	0
	5 > pH >9	Outside optimal range for reductive pathway	No	0	No	0	Yes	-2
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	No	0	No	0	No	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	No	0	No	0	No	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	No	0	No	0	No	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	Yes	1	Yes	1	Yes	1
Chloride*	>2x background	Daughter product of organic chlorine	No	0	No	0	No	0
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	Yes	3	No	0	NA	0
	<1 nM	VC oxidized	No	0	Yes	0	NA	0
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	No	0	No	0	No	0
PCE*		Material released	Yes	0	Yes	0	No	0
TCE*		Material released	Yes	0	Yes	0	No	0
		Daughter product of PCE a/	Yes	2	Yes	2	No	0
DCE*		Material released	No	0	No	0	No	0
		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE a/; 1,1-DCE can be a chem. reaction product of TCA	Yes	2	Yes	2	No	0
VC*		Material released	No	0	No	0	No	0
		Daughter product of DCE a/	Yes	2	Yes	2	No	0
1,1,1-Trichloroethane*		Material released	Yes	0	Yes	0	No	0
DCA		Daughter product of TCA under reducing conditions	Yes	2	Yes	2	Yes	2
Carbon Tetrachloride		Material released	No	0	No	0	No	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	No	0	Yes	2	No	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	No	0	No	0	No	0
	>0.1 mg/L	Daughter product of VC/ethene	No	0	No	0	No	0
Chloroform		Material released	Yes	0	Yes	0	No	0
		Daughter product of Carbon Tetrachloride	No	0	No	0	No	0
(Dichloromethane) Methylene Chloride		Material released	No	0	No	0	No	0
		Daughter product of Chloroform	Yes	2	No	0	Yes	2

Notes:
NA - Not available. Sample not collected
* Required analysis.
a/ Points awarded only if it can be shown that the constituent is a daughter product.

Table 4. ***Natural Attenuation Screening for Selected Monitoring Wells***
Maryland Sand, Gravel & Stone, Elkton, Maryland

Natural Attenuation Screening Protocol	Score	Interpretation	NDA SMW-14 Score:		NDA SMW-15 Score:		NDA SMW-17 Score:	
		Inadequate evidence for anaerobic biodegradation* of chlorinated organics						
		Limited evidence for anaerobic biodegradation* of chlorinated organics						
		Adequate evidence for anaerobic biodegradation* of chlorinated organics						
		Strong evidence for anaerobic biodegradation* of chlorinated organics						
Analysis	Concentration in Most Contam. Zone	Interpretation		Points Awarded		Points Awarded		Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	No	0	No	0	No	0
	>5mg/L	Not tolerated; however, VC may be oxidized aerobically	Yes	-3	Yes	-3	Yes	-3
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	No	0	Yes	2
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	No	0	No	0	Yes	3
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	No	0	Yes	2
Sulfide*	>1 mg/L	Reductive pathway possible	No	0	No	0	No	0
Methane*	<0.5 mg/L	VC oxidizes	Yes	0	Yes	0	Yes	0
	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	No	0	No	0	No	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	No	0	No	0	No	0
	<-100mV	Reductive pathway likely	No	0	No	0	No	0
pH*	5 < pH < 9	Optimal range for reductive pathway	Yes	0	No	0	Yes	0
	5 > pH >9	Outside optimal range for reductive pathway	No	0	Yes	-2	No	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	No	0	No	0	No	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	No	0	No	0	No	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	No	0	No	0	No	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	Yes	1	No	0	Yes	1
Chloride*	>2x background	Daughter product of organic chlorine	No	0	No	0	No	0
Hydrogen	>1 nM	Reductive pathway possible; VC may accumulate	Yes	3	No	0	Yes	3
	<1 nM	VC oxidized	No	0	Yes	0	No	0
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	No	0	No	0	Yes	2
PCE*		Material released	No	0	Yes	0	Yes	0
TCE*		Material released	No	0	No	0	Yes	0
		Daughter product of PCE a/	No	0	No	0	Yes	2
DCE*		Material released	No	0	No	0	No	0
		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE a/; 1,1-DCE can be a chem. reaction product of TCA	No	0	No	0	Yes	2
VC*		Material released	No	0	No	0	No	0
		Daughter product of DCE a/	No	0	No	0	Yes	2
1,1,1-Trichloroethane*		Material released	No	0	No	0	Yes	0
DCA		Daughter product of TCA under reducing conditions	No	0	No	0	Yes	2
Carbon Tetrachloride		Material released	No	0	No	0	No	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	No	0	No	0	Yes	2
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	No	0	No	0	No	0
	>0.1 mg/L	Daughter product of VC/ethene	No	0	No	0	No	0
Chloroform		Material released	No	0	Yes	0	Yes	0
		Daughter product of Carbon Tetrachloride	No	0	No	0	No	0
(Dichloromethane) Methylene Chloride		Material released	No	0	No	0	No	0
		Daughter product of Chloroform	No	0	Yes	2	No	0

Notes:
NA - Not available. Sample not collected
* Required analysis.
a/ Points awarded only if it can be shown that the constituent is a daughter product.

Table 4. ***Natural Attenuation Screening for Selected Monitoring Wells***
Maryland Sand, Gravel & Stone, Elkton, Maryland

Natural Attenuation Screening Protocol	Score	Interpretation	NDA SMW-18A Score:		NDA SMW-19A Score:	
		Inadequate evidence for anaerobic biodegradation* of chlorinated organics				
		Limited evidence for anaerobic biodegradation* of chlorinated organics				
		Adequate evidence for anaerobic biodegradation* of chlorinated organics				
		Strong evidence for anaerobic biodegradation* of chlorinated organics				
Analysis	Concentration in Most Contam. Zone	Interpretation		Points Awarded		Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	No	0	No	0
	>5mg/L	Not tolerated; however, VC may be oxidized aerobically	Yes	-3	No	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	No	0	Yes	2
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	No	0	Yes	3
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	No	0	Yes	2
Sulfide*	>1 mg/L	Reductive pathway possible	No	0	No	0
Methane*	<0.5 mg/L	VC oxidizes	Yes	0	Yes	0
	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	No	0	No	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	No	0	No	0
	<-100mV	Reductive pathway likely	No	0	No	0
pH*	5 < pH < 9	Optimal range for reductive pathway	No	0	Yes	0
	5 > pH >9	Outside optimal range for reductive pathway	Yes	-2	No	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	No	0	No	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	No	0	No	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	No	0	No	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	No	0	Yes	1
Chloride*	>2x background	Daughter product of organic chlorine	No	0	No	0
Hydrogen	>1 nM	Reductive pathway possible; VC may accumulate	NA	0	NA	0
	<1 nM	VC oxidized	NA	0	NA	0
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	No	0	No	0
PCE*		Material released	Yes	0	Yes	0
TCE*		Material released	Yes	0	Yes	0
		Daughter product of PCE a/	Yes	2	Yes	2
DCE*		Material released	No	0	No	0
		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE a/; 1,1-DCE can be a chem. reaction product of TCA	Yes	2	Yes	2
VC*		Material released	No	0	No	0
		Daughter product of DCE a/	No	0	Yes	2
1,1,1-Trichloroethane*		Material released	Yes	0	Yes	0
DCA		Daughter product of TCA under reducing conditions	Yes	2	Yes	2
Carbon Tetrachloride		Material released	No	0	No	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	No	0	Yes	2
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	No	0	Yes	2
	>0.1 mg/L	Daughter product of VC/ethene	No	0	No	0
Chloroform		Material released	Yes	0	Yes	0
		Daughter product of Carbon Tetrachloride	No	0	No	0
(Dichloromethane) Methylene Chloride		Material released	No	0	No	0
		Daughter product of Chloroform	No	0	Yes	2

Notes:
NA - Not available. Sample not collected.
* Required analysis.
a/ Points awarded only if it can be shown that the constituent is a daughter product.

Table 4. Natural Attenuation Screening for Selected Monitoring Wells
Maryland Sand, Gravel & Stone, Elkton, Maryland

Natural Attenuation Screening Protocol	Score	Interpretation	PO2 TMW-5		PO2 SMW-7	
	[redacted]	Inadequate evidence for anaerobic biodegradation* of chlorinated organics				
		Limited evidence for anaerobic biodegradation* of chlorinated organics	Score: [redacted]		Score: [redacted]	
		Adequate evidence for anaerobic biodegradation* of chlorinated organics				
		Strong evidence for anaerobic biodegradation* of chlorinated organics				
Analysis	Concentration in Most Contam. Zone	Interpretation		Points Awarded		Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	No	0	No	0
	>5mg/L	Not tolerated; however, VC may be oxidized aerobically	No	0	No	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	Yes	2
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	Yes	3	Yes	3
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	Yes	2
Sulfide*	>1 mg/L	Reductive pathway possible	No	0	No	0
Methane*	<0.5 mg/L	VC oxidizes	No	0	No	0
	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	Yes	3	Yes	3
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	Yes	1	Yes	1
	<-100mV	Reductive pathway likely	No	0	No	0
pH*	5 < pH < 9	Optimal range for reductive pathway	Yes	0	Yes	0
	5 > pH >9	Outside optimal range for reductive pathway	No	0	No	0
TOC	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	Yes	2	No	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	No	0	No	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	No	0	No	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	Yes	1	Yes	1
Chloride*	>2x background	Daughter product of organic chlorine	No	0	No	0
Hydrogen	>1 nM	Reductive pathway possible; VC may accumulate	Yes	3	Yes	3
	<1 nM	VC oxidized	No	0	No	0
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	Yes	2	Yes	2
PCE*		Material released	No	0	No	0
TCE*		Material released	No	0	No	0
		Daughter product of PCE a/	No	0	No	0
DCE*		Material released	No	0	No	0
		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE*/; 1,1-DCE can be a chem. reaction product of TCA	No	0	No	0
VC*		Material released	No	0	No	0
		Daughter product of DCE*/	No	0	No	0
1,1,1-Trichloroethane*		Material released	No	0	No	0
DCA		Daughter product of TCA under reducing conditions	Yes	2	No	0
Carbon Tetrachloride		Material released	No	0	No	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	Yes	2	Yes	2
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	Yes	2	Yes	2
	>0.1 mg/L	Daughter product of VC/ethene	Yes	3	Yes	3
Chloroform		Material released	Yes	0	No	0
		Daughter product of Carbon Tetrachloride	No	0	No	0
(Dichloromethane) Methylene Chloride		Material released	No	0	No	0
		Daughter product of Chloroform	No	0	No	0

Notes:
NA - Not available. Sample not collected.
* Required analysis.
a/ Points awarded only if it can be shown that the constituent is a daughter product.

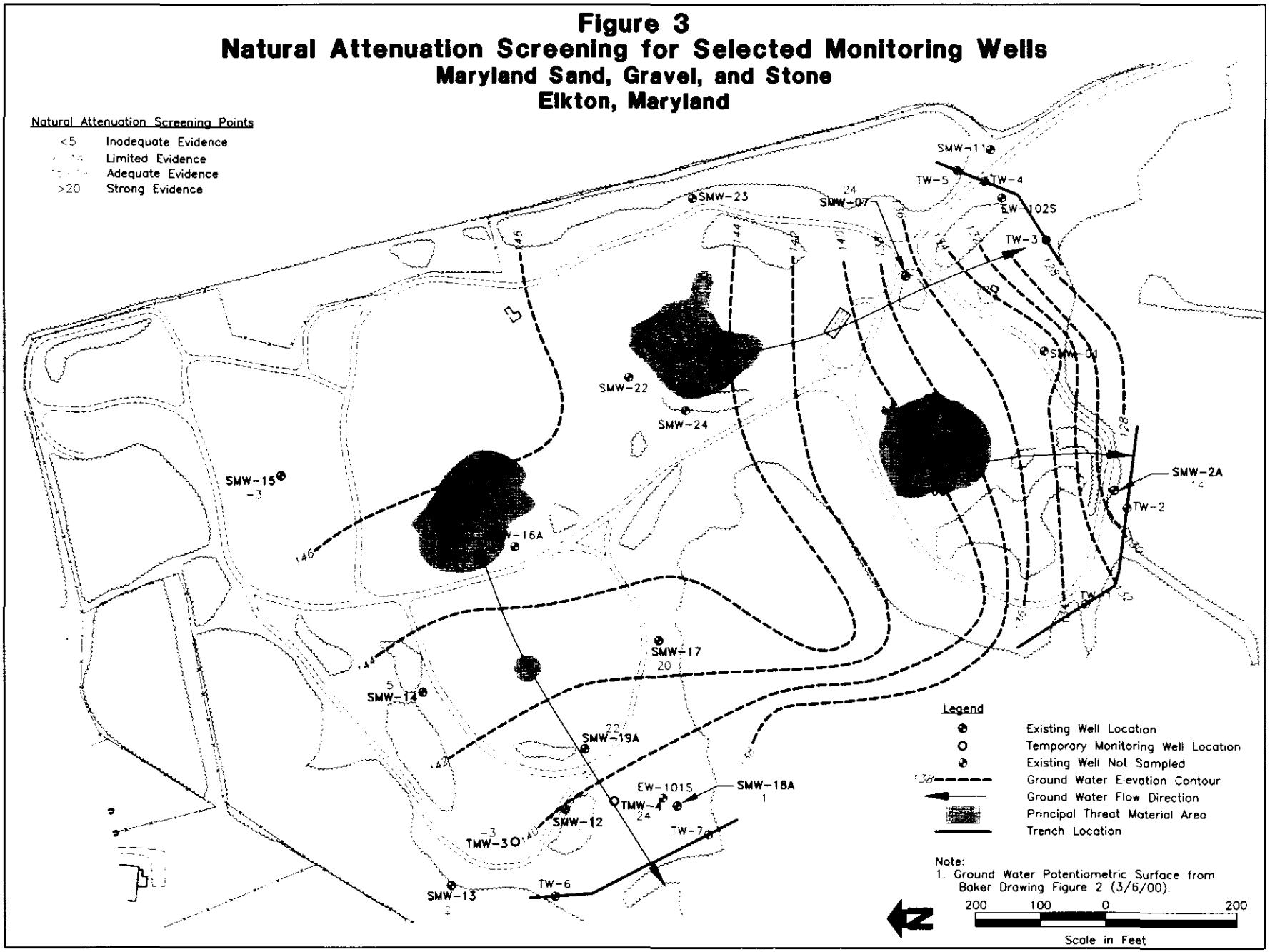
Table 4. Natural Attenuation Screening for Selected Monitoring Wells
Maryland Sand, Gravel & Stone, Elkton, Maryland

Natural Attenuation Screening Protocol	Score	Interpretation	BWA TMW-6 Score:		BWA SMW-2A Score:	
		Inadequate evidence for anaerobic biodegradation* of chlorinated organics				
		Limited evidence for anaerobic biodegradation* of chlorinated organics				
		Adequate evidence for anaerobic biodegradation* of chlorinated organics				
		Strong evidence for anaerobic biodegradation* of chlorinated organics				
Analysis	Concentration in Most Contam. Zone	Interpretation		Points Awarded		Points Awarded
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	No	0	No	0
	>5mg/L	Not tolerated; however, VC may be oxidized aerobically	No	0	Yes	-3
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	Yes	2
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	Yes	3	No	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	Yes	2	Yes	2
Sulfide*	>1 mg/L	Reductive pathway possible	No	0	No	0
Methane*	<0.5 mg/L	VC oxidizes	No	0	Yes	0
	>0.5 mg/L	Ultimate reductive daughter product, VC Accumulates	Yes	3	No	0
Oxidation Reduction Potential* (ORP)	<50 millivolts (mV)	Reductive pathway possible	Yes	1	No	0
	<-100mV	Reductive pathway likely	No	0	No	0
pH*	5 < pH < 9	Optimal range for reductive pathway	Yes	0	Yes	0
	5 > pH >9	Outside optimal range for reductive pathway	No	0	No	0
TOC*	>20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	No	0	No	0
Temperature*	>20°C	At T >20°C biochemical process is accelerated	No	0	No	0
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	No	0	No	0
Alkalinity	>2x background	Results from interaction of carbon dioxide with aquifer minerals	Yes	1	No	0
Chloride*	>2x background	Daughter product of organic chlorine	No	0	No	0
Hydrogen	>1 nM	Reductive pathway possible; VC may accumulate	Yes	3	Yes	3
	<1 nM	VC oxidized	No	0	No	0
BTEX*	>0.1 mg/L	Carbon and energy source; drives dechlorination	Yes	2	No	0
PCE*		Material released	Yes	0	Yes	0
TCE*		Material released	No	0	No	0
		Daughter product of PCE a/	No	0	Yes	2
DCE*		Material released	No	0	No	0
		Daughter product of TCE. If cis is greater than 80% of total DCE it is likely a daughter product of TCE a/, 1,1-DCE can be a chem. reaction product of TCA	No	0	Yes	2
VC*		Material released	No	0	No	0
		Daughter product of DCE a/	No	0	Yes	2
1,1,1-Trichloroethane*		Material released	No	0	Yes	0
DCA		Daughter product of TCA under reducing conditions	No	0	Yes	2
Carbon Tetrachloride		Material released	No	0	No	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	Yes	2	No	0
Ethene/Ethane	>0.01 mg/L	Daughter product of VC/ethene	Yes	2	No	0
	>0.1 mg/L	Daughter product of VC/ethene	Yes	3	No	0
Chloroform		Material released	No	0	Yes	0
		Daughter product of Carbon Tetrachloride	No	0	No	0
(Dichloromethane) Methylene Chloride		Material released	No	0	No	0
		Daughter product of Chloroform	No	0	Yes	2

Notes:
NA - Not available. Sample not collected.
* Required analysis.
a/ Points awarded only if it can be shown that the constituent is a daughter product

ERM, INC.

Figure 3
Natural Attenuation Screening for Selected Monitoring Wells
Maryland Sand, Gravel, and Stone
Elkton, Maryland



48410.01.01/08.01.01-MLB/06.04.01-CMP/1103-1A

main flowpath downgradient from the principal threat area. SMW-17 is located approximately 200 feet south of the flowpath centerline based on the potentiometric surface developed from water level data collected on 6 March 2000. Historically, as on 23 September 1999, SMW-17 has received direct flow from the NDA principal threat area and may explain the elevated concentrations observed at this well. At well SMW-18A, the analytical data did show complete aerobic degradation of vinyl chloride and chloroethane to ethene and ethane is occurring. In addition to the chlorinated ethenes and ethanes, chlorobenzene showed strong evidence of degradation in this area.

The remaining four wells [TMW-3, SMW-13, SMW-14 and SMW-15 (upgradient sample)] are located around the perimeter of the dissolved chlorinated hydrocarbon plume and indicated oxidizing and/or aerobic conditions. Although anaerobic degradation is not likely occurring at these locations, the VOC data do suggest that aerobic degradation of vinyl chloride is occurring. Downgradient monitoring wells SMW-13 and SMW-14 are not contaminated with chlorinated VOCs.

Pond 02 Wet Area (Pond 02)

The ground water sample collected from Pond 02 principal threat area temporary well TMW-5S was not included in the AFCEE screening since it was located immediately within the source hot spot. The remaining well in this area, TMW-5, and the downgradient well, SMW-7, both showed strong evidence for anaerobic biodegradation of chlorinated ethanes. The parent compounds were not detected in ground water samples collected from either of these wells. Chlorobenzene concentrations remained relatively stable along the plume flowpath and do not show evidence of attenuation.

Buried Waste Area (BWA)

TMW-6 in the principal threat area at BWA showed strong evidence of anaerobic biodegradation with conversion of chloroethane to ethane, but only a trace of ethene was detected from degradation of the PCE. The downgradient well, SMW-2A, also showed limited transformation of TCA to 1,1-DCE with a trace ethane and PCE transformation to vinyl chloride with a trace of ethene. Chlorobenzene also showed significant evidence of degradation along the plume flowpath. Concentrations of chlorobenzene were reduced from 3.7 mg/L (TMW-6) to less than 1 µg/L (SMW-2A).

A ground water sample was not collected from temporary well TMW-6S due to the presence of a dense-NAPL (DNAPL) present in the well. Consequently this well was not included in the AFCEE screening.

4.2 *NATURAL ATTENUATION RATE ESTIMATES*

The determination of whether biodegradation is occurring was the initial step in the screening protocol (EPA, 1998). Since the initial scoring indicated that there is adequate to strong evidence of biodegradation, the rate of attenuation relative to the rate of contaminant transport in ground water was quantified.

The one-dimensional, analytic solute transport model BIOCHLOR v 2.0 (EPA, 2001) was used to estimate the natural attenuation rate constants for chlorinated ethenes and chlorobenzene at the NDA. Selected wells located along the principal ground water flowpath emanating from the NDA principal threat area were used to determine the attenuation rates. The aqueous concentrations of TCE and PCE in well TMW-2S were used as the source area concentrations for the simulation. Based on the geometry of the principal threat area and detection of LNAPL at NDA-11 and TMW-1S a source width of 30 feet was selected. The source thickness was assumed to be 1 foot thick. Site-specific values for ground water velocity, soil bulk density and organic carbon content were used in the model. A coefficient of dispersion was estimated using the Xu and Eckstein relationship with flow path length included within BIOCHLOR. A summary of BIOCHLOR input parameters is contained in Table 5.

To calculate the natural attenuation rate constants the data simulated by BIOCHLOR was adjusted to best fit the recent field data collected from downgradient wells SMW-19A, SMW-12, SMW-18A and TMW-4. To adjust the simulated data the degradation rate constant for each constituent was increased while the site-specific hydrogeological parameters (e.g., dispersion, velocity, retardation, etc.) remained unchanged. The natural attenuation rate constants and half-lives for the chlorinated ethenes and chlorobenzene are summarized below.

Table 5. Summary of BIOCHLOR Input Parameters and Rational
Maryland Sand, Gravel and Stone, Elkton, Maryland

Data Type	Parameter	Value				Source of Data / Rational
Hydrogeology	Hydraulic Conductivity	9×10^{-4} (cm/sec)				- Calculated from single well drawdown tests performed by ERM in May 2001.
	Hydraulic Gradient	0.011 (ft/ft)				- Calculated from May 2001 ground water elevation data.
	Effective Porosity	0.36				- Estimated from site specific soil bulk density values.
	Seepage Velocity	28.5 (ft/year)				- Calculated from V=Ki/n.
Dispersion	Longitudinal Dispersivity	19.8 (ft)				- Based on Xu and Eckstein
	Transverse Dispersivity	1.98 (ft)				- 0.1 x long. Dispersivity
	Vertical Dispersivity	0 (ft)				- Assume vertical dispersivity is negligable and plume thickness is the depth of aquifer.
Adsorption	TCE Retardation Factor	1				- Calculated from $R=1+K_{oc}*f_{oc}*\rho_b/n$
	Aquifer Matrix Bulk Density	1.67 (kg/L)				- Laboratory analysis.
	foc	2.5 E-4				- Laboratory analysis.
	Koc (Chlorobenzene)	331 L/kg, 47 L/kg				- Literature correlation.
	Koc (Methylene Chloride)	9 L/kg				
	Koc (Ethenes)	PCE - 209 L/kg, TCE - 87 L/kg, DCE - 49 L/kg, VC - 3 L/kg				
	Koc (Ethanes)	TCA - 151 L/kg, DCA - 30 L/kg, CA - 3 L/kg				
General	Modeled Area Length	600 (ft)				- Based on area of affected ground water plume.
	Modeled Area Width	225 (ft)				
	Simulation Time	32 (years)				- Elapsed time of contamination in the subsurface (1969-2001).
Source Data	Thickness	1 (ft)				- Based on evidence of LNAPL at adjacent well TMW-1S. Not a sensitive parameter in the model.
	Width	30 (ft)				- Based on geometry of NDA and soil sampling results
	Chlorobenzene Concentration	57 (mg/L)				- Dissolved concentration at source area well TMW-2S.
	Methylene Chloride Concentration	43 (mg/L)				
	1,1,1-TCA Concentration	74 (mg/L)				
	PCE Concentration	17 (mg/L)				
	TCE Concentration	43 (mg/L)				
Actual Data	Distance From Source (feet)	410	467	507	547	- Based on observed concentrations at site near centerline of plume.
	PCE Conc. (mg/L)	0.087	0.056	0.130	0.008	
	TCE Conc. (mg/L)	0.020	0.022	0.037	0.027	
	1,2-DCE Conc. (mg/L)	0.058	0.038	0.017	0.008	
	VC Conc. (mg/L)	0.028	0.013	0.071	0.000	
	Ethene Conc. (mg/L)	0.063	0.001	0.000	0.000	
	1,1,1-TCA Conc. (mg/L)	0.150	0.084	0.130	0.260	
	1,1-DCA Conc. (mg/L)	0.140	0.070	0.026	0.600	
	CA Conc. (mg/L)	0.026	0.003	0.000	0.000	
	Chlorobenzene Conc. (mg/L)	0.025	0.038	0.021	0.005	
	Methylene Chloride Conc. (mg/L)	0.007	0.000	0.002	0.000	

BIOCHLOR Natural Attenuation Rate Estimates

	1st Order Loss Rate (1/year)	Half-Life (years)	Published Ranges of Half-lives[1] (years)	
			Aerobic	Anaerobic
PCE	0.32	2.20	1.0 - 2.0 [a]	0.3 - 4.5
TCE	0.58	1.20	0.5 - 1.0	0.9 - 4.5 [a]
1,2-DCE	1.26	0.55	0.2 - 7.9 [a]	0.3 - 2.0
Vinyl Chloride	1.87	0.37	0.08 - 0.5	0.2 - 7.9 [a]
1,1,1-TCA	0.43	1.63	0.4 - 1.5 [a]	1.5 - 3.0
1,1-DCA	0.73	0.95	0.2 - 0.4 [a]	0.4 - 1.7
Chloroethane	3.46	0.20	0.04 - 0.2 [a]	0.08 - 0.3
Methylene Chloride	0.69	1.00	0.04 - 0.2 [a]	0.08 - 0.3
Chlorobenzene	0.51	1.35	0.4 - 0.8 [a]	0.8 - 1.6

[1] Reported [(a)] values are ground water half-lives. All other values are for aqueous biodegradation. All values are reported in Howard et al.., (1991)..

The half-life reflects the time it will take for a given contaminant to reduce its concentration by 50 percent. For example, if it takes 2.4 years for ground water to reach a well downgradient of a source area (100 mg/L) the concentration of TCE (based on a half-life of 1.2 years) in that well will be 25 mg/L.

5.0 SUMMARY

The following information was obtained from the ground water biodegradation screening investigation.

1. Aquifer test data indicate the hydraulic conductivity of the Upper Sand Aquifer was on the order of 10^{-3} to 10^{-4} cm/sec, which is consistent with previous findings for the site. Hydraulic conductivity values were typically higher in the NDA than in Pond 02 and BWA.

2. Within each of the three main principal threat areas, the deep wells typically showed one to two orders of magnitude less ground water impact by chlorinated organics than at the adjacent water table wells. This may suggest that the actual dilution rate is greater than dilution rate calculated using the site screening level (SSL) methodology, or that natural degradation is significantly reducing VOC concentrations beyond simple dilution.

3. Non-aqueous phase contamination was observed at the water table in the NDA and BWA principal threat areas. Two discrepancies regarding the submittal and analysis of free-product samples from shallow wells TMW-1S and TMW-6S are noted as follows.

    - In a more detailed review of the laboratory data for the TMW-1S sample, it was evident that product-level concentrations for both light and heavy VOCs were present in the sample from the shallow well (refer to TMW-1S and TMW-1S-RE1 in the revised Table 2). It is possible that a cosolvation/emulsion effect of these compounds has occurred, and the mixture happens to have a density equal to, or slightly less than water, creating what appears to be a LNAPL as opposed to a DNAPL. A comparison of solubilities indicates all of the solvents present are, for the most part, miscible in each other.

    - During ground water sampling activities, field team members observed a NAPL in the bottom of a bailer during purging at the TMW-6S well. This sample was submitted to the laboratory as a NAPL sample. The laboratory did not observe any separate phase product in the sample container and identified the liquid as having a specific gravity similar to water. Nevertheless, the sample results from the laboratory were reported as a separate phase with units of µg/kg.

No non-aqueous phase liquid (NAPL) was observed in any of the deep wells installed in the three principal threat areas during this investigation (TMW-1, TMW-2, TMW-5 and TMW-6). However, some VOC concentrations reported in Upper Sand wells downgradient of the BWA[1] (Phase I/Phase II Quarterly Ground Water Monitoring Reports prepared by Baker Environmental, Inc.) may be suggestive of some DNAPL impacts in this area of the Site.

4. The analytical data demonstrate that complete dechlorination of tetrachloroethene (PCE) to ethene and 1,1,1-trichloroethane (TCA) to ethane is occurring in some areas of the site. However, complete dechlorination is not observed throughout the site. Complete dechlorination does appear to be occurring in the Pond 02 wet area, if well SMW-7 is located in the flowpath downgradient of Pond 02. The data indicate that at the NDA and BWA principal threat areas, dechlorination is generally limited in the source areas with more extensive dechlorination occurring in the downgradient areas. Total VOC concentrations decreased from 472 mg/L (TMW-2S) to 462 µg/L (TMW-4) over a distance of about 500 feet, in the April-May 2001 sampling events.

5. In general, those wells with detectable benzene, toluene, ethylbenzene and/or xylenes (BTEX) yielded strong evidence for dechlorination. This suggests that the availability of degradable substrate is likely the limiting factor for dechlorination. The presence of BTEX appears to facilitate the reductive dechlorination the chlorinated solvents dissolved in ground water.

6. The background well, SMW-15, and the plume fringe wells showed adequate chemical evidence of aerobic degradation through the removal of vinyl chloride. This was supported by AFCEE screening values for wells on the edge of the plumes.

7. The data suggest that significant degradation of chlorobenzene is occurring in the anaerobic portions of the NDA and BWA. Chlorobenzene levels in the downgradient ground water monitoring wells in these areas, are below 100 µg/L.

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[1] Buried drums were removed from this area in 1990 as part of the OU1 remedy.

8. Chlorobenzene does not appear to be significantly degrading at the Pond 02 principal threat area. Similarly, BTEX concentrations in the downgradient well at Pond 02 remain elevated. This is likely a result of an oxygen depleted environment. Following the complete degradation of chlorinated ethenes and ethanes, BTEX will not be co-metabolized by the anaerobic microbes. Aerobic treatment may be required to treat chlorobenzene, benzene, toluene, ethylbenzene, and xylenes remaining after anaerobic reductive dechlorination is completed.

9. Natural attenuation half-lives (accounting for dilution, sorption, volatilization and biodegradation) for PCE, TCE, 1,2-DCE vinyl chloride and chlorobenzene (as calculated using site-specific data and EPA's BIOCHLOR model) were on the order of 0.4 to 2.2 years and are in excellent agreement with published rates (Howard, Boethling, Jarvis, Meylan and Michalenko, 1991).

6.0 CONCLUSIONS

The ground water biodegradation screening investigation results indicate that there is adequate to strong evidence of naturally-occurring degradation by reductive dechlorination occurring downgradient of the three principal threat source areas at the MSG&S Site. In addition, degradation of all of the other constituents of concern to ground water was observed to some extent on the site. The data suggest that all of the constituents of concern are amenable to in-situ biodegradation under the appropriate conditions. In some areas of the site, the existing biodegradation appears to be constrained by the availability of one or more necessary precursors. Biodegradation may need to be optimized through the addition of nutrients, supplemental carbon, or possibly microorganisms in some areas of the site.

The results of this investigation suggest that the enhancement of in-situ biodegradation, in conjunction with continued operation of the existing ground water recovery and treatment system and treatment of ground water principal threat soil, will substantially accelerate the removal of contaminants from ground water at the site. Ground water concentrations in the NDA were observed to decrease by orders of magnitude in both the lateral and vertical directions under existing conditions.

The positive results from this screening investigation indicate that additional pre-design studies are warranted. A more detailed evaluation of the site wide ground water data is necessary to assess the applicability of the findings from the NDA study area to other areas of the site, and to identify current constraints on biodegradation. Microcosm studies are needed to evaluate methods to augment natural biological and geochemical conditions in order to design the appropriate enhancements to accelerate biodegradation in the dissolved ground water plume. These microcosm studies would include the investigation of carbon addition to facilitate complete anaerobic degradation, as well as investigation of the use of aerobic zones as a polishing step to remove those constituents that may be more efficiently treated through aerobic degradation.

7.0 REFERENCES

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Appendices

Appendix A
Well Completion Logs

Environmental Resources Management, Inc.

Boring Log

Boring Number:
NDA-08 / TMW-1 / TMW-1S

Site Name & Location		Project Number	Date & Time Started	3/14/01	
MD Sand Gravel & Stone		48410.01	Date & Time Completed	3/14/01	
Drilling Company		Driller	Sampler(s)	Sampler Depth	
Tidewater, Inc.		Pete Miller		4 feet	
Drilling Equipment		Method	Elevation & Datum	Completion Depth	Rock Depth
Geoprobe 66DT		Direct-Push		44 feet bgs	NA
Bit Size		Core Barrel (s)	North Coordinate		
2 inch		4-foot soil core			
Geologist(s)			East Coordinate		
Matt Erbe / Brent Williams					

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
0	1	2.0	82.3		*Fine SAND, light brown (5 YR 5/6), strong odor, dry.*	*Soil color based on Munsell charts.* USCS grain size classification.
2						
4	2	2.5	>2000		Fine SAND, light brown, occasional pebbles, strong odor, dry.	
6					*At 7 feet, Silty SAND, grayish orange (10 YR 7/4),* trace Clay.	
8	3	1.5	>2000		As above, wood fragments, grades to light brown, strong odor, moist.	
10						
12	4	3.0	>2000		Fine SAND, moderate brown (5 YR 3/4 to 4/4), little Silt, occasional coase Gravel, strong odor, wet.	TCLP metals + thallium RCRA metals + thallium
14						
	5	0.9	>2000		As above, pushed Gravel from 16 feet to 18 feet.	
16						
18	6	2.0	>2000		As above with iron concretions to 18.5 feet. At 18.5 feet, medium SAND, dark yellowish orange (10 YR 6/6), trace coarse Sand, moderate orange pink (5 YR 8/4), strong odor, wet.	

Signature:_____ Date:_____

Environmental Resources Management, Inc.

Boring Log

Boring Number:
NDA-08 / TMW-1 / TMW-1S

Site Name & Location	Project Number	Date & Time Started	3/14/01	
MD Sand Gravel & Stone	48410.01	Date & Time Completed	3/14/01	
Drilling Company	Driller	Sampler(s)	Sampler Depth	
Tidewater, Inc.	Pete Miller		4 feet	
Drilling Equipment	*Method*	*Elevation & Datum*	*Completion Depth*	*Rock Depth*
Geoprobe 66DT	Direct-Push		44 feet bgs	NA
Bit Size	Core Barrel (s)	North Coordinate		
2 inch	4-foot soil core			
Geologist(s)		East Coordinate		
Matt Erbe / Brent Williams				

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
20	6	2.0	>2000		At 18.5 feet, medium SAND, dark yellowish orange (10 YR 6/6), trace coarse Sand, moderate orange pink (5 YR 8/4), strong odor, wet.	Soil color based on Munsell charts. USCS grain size classification.
22	7	2.0	>2000		Very fine SAND and SILT, dark yellowish brown (10 YR 4/2), light brown (5 YR 4/6) and dusky yellowish brown (10 YR 2/2), strong odor, wet. At 23.5 feet, medium to coarse SAND, grayish orange.	
24	8	2.0	>2000		As above. At 25.5 feet, 0.2 feet of very coarse SAND, medium blueish gray (5 B 5/1).	
26	9	4.0	158		Medium coarse SAND, blueish gray, occasional fine subrounded Gravel, wet.	
28						
30	10	3.0	1561		As above.	
32						
	11	3.0	159		As above.	
34						
					At 35.8 feet, very fine SAND, very pale orange with very dark red (5 R 2/6) banding.	PID = 56 ppm.
36	12	2.0	NR		As above.	Sample lost, jammed in liner.
38	13	2.0	18.6		Very fine SAND to SILT, color as above, trace Clay.	

Signature:_____ Date:_____

Environmental Resources Management, Inc.
Boring Log

Boring Number:
NDA-08 / TMW-1 / TMW-1S

Site Name & Location MD Sand Gravel & Stone	Project Number 48410.01	Date & Time Started 3/14/01	
		Date & Time Completed 3/14/01	
Drilling Company Tidewater, Inc.	*Driller* Pete Miller	*Sampler(s)*	*Sampler Depth* 4 feet
Drilling Equipment *Geoprobe 66DT*	Method *Direct-Push*	Elevation & Datum	Completion Depth *44 feet bgs* / Rock Depth *NA*
Bit Size 2 inch	Core Barrel (s) 4-foot soil core	North Coordinate	
Geologist(s) Matt Erbe / Brent Williams		East Coordinate	

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
40	14	4.0	15.1		As above to 43.7 feet.	Soil color based on Munsell charts. USCS grain size classification.
42					At 43.7 feet, CLAY, grayish orange pink (10 R 8/2) with thin (1/8") very dark red layering.	Basal Clay.
44					*End of boring at 44 feet bgs.*	Temporary Well Installation TMW-1 Set 1-inch PVC well at 44 feet bgs. 5-foot prepacked screen. Sand to 37 feet bgs. Bentonite to 0 feet bgs. TMW-1S Set 1-inch PVC well at 23.3 feet bgs. 5-foot prepacked screen. *Sand to 16 feet bgs.* Bentonite to 14 feet bgs.
46						
48						
50						
52						
54						
56						
58						

Signature:_____ Date:_____

Environmental Resources Management, Inc.
Boring Log

Boring Number:
NDA-09 / TMW-2 / TMW-2S

Site Name & Location MD Sand Gravel & Stone	Project Number 48410.01	Date & Time Started Date & Time Completed	3/14/01 3/15/01
Drilling Company Tidewater, Inc.	Driller Pete Miller	Sampler(s)	Sampler Depth 4 feet
Drilling Equipment *Geoprobe 66DT*	Method *Direct-Push*	Elevation & Datum	Completion Depth: *44 feet bgs* Rock Depth: *NA*
Bit Size 2 inch	Core Barrel (s) 4-foot soil core	North Coordinate	
Geologist(s) Matt Erbe / Brent Williams		East Coordinate	

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
0	1	1.5	NR		Fine SAND, light brown (5 YR 5/6), dry.	Soil color based on Munsell charts. USCS grain size classification. NR - Not recorded.
2						
4	2	2.2	NR	■	Fine SAND, light brown, occasional pebbles and coarse Sand, very dark red (5R 2/6) mottling.	TOC sample
6						
8						
10	3	2.0	NR	■	As above.	TOC sample
12						
14	4	2.1	NR	■	As above.	TOC sample
16						
18					At 19 feet, yellow (5 Y 7/6) liquid.	

Signature:_____ Date:_____

Environmental Resources Management, Inc.
Boring Log

Boring Number:
NDA-09 / TMW-2 / TMW-2S

Site Name & Location	Project Number	Date & Time Started	3/14/01	
MD Sand Gravel & Stone	48410.01	Date & Time Completed	3/15/01	
Drilling Company	Driller	Sampler(s)	Sampler Depth	
Tidewater, Inc.	Pete Miller		4 feet	
Drilling Equipment	Method	Elevation & Datum	Completion Depth	Rock Depth
Geoprobe 66DT	Direct-Push		44 feet bgs	NA
Bit Size	Core Barrel (s)	North Coordinate		
2 inch	4-foot soil core			
Geologist(s)		East Coordinate		
Matt Erbe / Brent Williams				

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
20	5	3.0	NR		Fine SAND, moderate yellowish brown (10 YR 5/4). Yellow liquid present to 23 feet.	Soil color based on Munsell charts. USCS grain size classification. TOC sample
22						
24						
	6	0.2	NR		Fine to medium SAND, moderate yellowish brown.	TOC sample
26						
28						
30	7	0.0	NR		As above, some discoloration with yellow liquid.	TOC sample
32						
34	8	0.0	NR		Very fine SAND, very pale orange with very dark red (5 R 2/6) banding.	PID = 56 ppm.
36						Sample lost, jammed in liner.
38	9				Very fine SAND to SILT, color as above, trace Clay.	

Signature:_____ Date:_____

Environmental Resources Management, Inc.
Boring Log

Boring Number:
NDA-09 / TMW-2 / TMW-2S

Site Name & Location MD Sand Gravel & Stone	Project Number 48410.01	Date & Time Started Date & Time Completed	3/14/01 3/15/01
Drilling Company Tidewater, Inc.	Driller Pete Miller	Sampler(s)	Sampler Depth 4 feet
Drilling Equipment Geoprobe 66DT	Method Direct-Push	Elevation & Datum	Completion Depth: 44 feet bgs Rock Depth: NA
Bit Size 2 inch	Core Barrel (s) 4-foot soil core	North Coordinate	
Geologist(s) Matt Erbe / Brent Williams		East Coordinate	

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
40					As above.	Soil color based on Munsell charts. USCS grain size classification.
42	10				At 44 feet, CLAY, grayish orange pink (10 R 8/2) with thin (1/8") very dark red layering.	Basal Clay.
44					End of boring at 44 feet bgs.	Temporary Well Installations TMW-2 Set 1-inch PVC well at 44 feet bgs. 5-foot prepacked screen. Sand to 37 feet bgs. Bentonite to 15 feet bgs. TMW-2S Set 1-inch PVC well at 23.5 feet bgs. 5-foot prepacked screen. Sand to 17 feet bgs. Bentonite to15 feet bgs.
46						
48						
50						
52						
54						
56						
58						

Signature:_____ Date:_____

Environmental Resources Management, Inc.

Boring Log

Boring Number: **TMW-3**

Site Name & Location: MD Sand Gravel & Stone	Project Number: 48410.23	Date & Time Started: 3/15/01	
		Date & Time Completed: 3/20/01	
Drilling Company: Tidewater, Inc.	Driller: Pete Miller	Sampler(s)	Sampler Depth: 4 feet
Drilling Equipment: Geoprobe 66DT	Method: Direct-Push	Elevation & Datum	Completion Depth: 12 feet bgs
Bit Size: 2 inch	Core Barrel (s): 4-foot soil core	North Coordinate	
Geologist(s): Matt Erbe / Brent Williams		East Coordinate	

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
0	1	3.0	0		Moderate reddish-brown (10 R 4/6) fine SAND, little Silt, trace Clay.	Soil color based on Munsell charts. USCS grain size classification. NR - Not recorded.
2					Dark red brown (10 R 3/4) fine SAND, some Gravel.	
					Light brown (5 YR 5/6) medium SAND. At 3.7 feet, very light gray (N*) SILT, some fine Sand, and trace Clay.	
4	2	4.0	0		At 4 feet, dark yellowish orange (10 YR 6/6) fine GRAVEL and coarse SAND.	
6						
					Moderate yellow-brown (10 YR 5/4) SAND, wet.	
8	3	3.0	0		Pale yellow orange (10 YR 8/6) medium to coarse SAND.	
10						
					At 11.8 feet, pinkish gray (5 YR 8/1) CLAY.	
12					End of boring at 12 feet bgs.	*Temporary Well Installation* TMW-3 Set 1-inch PVC well at 12 feet bgs. 5-foot prepacked screen. *Sand to 5 feet bgs.* Bentonite to 3 feet bgs.
14						
16						
18						

Signature:_____ Date:_____

Environmental Resources Management, Inc.

Boring Log

Boring Number: **TMW-4**

Site Name & Location	Project Number	Date & Time Started	3/15/01
MD Sand Gravel & Stone	48410.23	Date & Time Completed	3/15/01
Drilling Company	Driller	Sampler(s)	Sampler Depth
Tidewater, Inc.	Pete Miller		4 feet
Drilling Equipment	Method	Elevation & Datum	Completion Depth
Geoprobe 66DT	Direct-Push		24 feet bgs
Bit Size	Core Barrel (s)	North Coordinate	
2 inch	4-foot soil core		
Geologist(s)		East Coordinate	
Matt Erbe / Brent Williams			

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
0	1	1.0	0		Light to moderate brown (5 YR 5/6 to 5 YR 4/4), fine SAND, little Silt, twigs, leaves, occassional quartz fine round gravel, trace very light gray Silt, dry.	Soil color based on Munsell charts. USCS grain size classification.
2						
4	2	0.5	0		*Very dark red ironstone.*	
6						
8	3	0.0	NA		No recovery.	NA - Not available.
10						
12	4	3.0	0		Moderate reddish orange (10 R 6/6) fine to coarse SAND, little fine to medium subrounded Gravel.	
					Very light gray laminated Clayey SILT.	
14					Fine to medium SAND, little Silt, dry.	
	5	3.0	0		Moderate reddish orange to dark yellow orange fine SAND, little Silt, grades to medium Sand.	
16						
					Wet.	
18	6	3.0	0		Dark yellow orange (0.2 feet) SAND, then dark gray (N3) stained fine to medium SAND, micaceous, few pebbles, wet.	

Signature:_____ Date:_____

Environmental Resources Management, Inc.

Boring Number: **TMW-4**

Boring Log

Site Name & Location	Project Number	Date & Time Started	3/15/01	
MD Sand Gravel & Stone	48410.23	Date & Time Completed	3/15/01	
Drilling Company	Driller	Sampler(s)	Sampler Depth	
Tidewater, Inc.	Pete Miller		4 feet	
Drilling Equipment	Method	Elevation & Datum	Completion Depth	Rock Depth
Geoprobe 66DT	*Direct-Push*		*24 feet bgs*	*0*
Bit Size	Core Barrel (s)	North Coordinate		
2 inch	4-foot soil core			
Geologist(s)		East Coordinate		
Matt Erbe / Brent Williams				

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
20						Soil color based on Munsell charts. USCS grain size classification.
	7	3.0	0		As above to 22.5 feet.	
22					Grades to light gray very fine SAND with some dark red banding.	
					Light gray CLAY at 23.9 feet.	
24					End of boring at 24 feet bgs.	Temporary Well Installation TMW-4 Set 1-inch PVC well at 14 feet bgs. 5-foot prepacked screen. Sand to 17 feet bgs. Bentonite to 15 feet bgs.
26						
28						
30						TOC sample
32						
34						
						PID = 56 ppm.
36						Sample lost, jammed in liner.
38						

Signature:_____ Date:_____

Environmental Resources Management, Inc.

Boring Log

Boring Number:
PO2-19 / TMW-5 / TMW-5S

Site Name & Location	Project Number	Date & Time Started	3/13/01	
MD Sand Gravel & Stone	48410.01	Date & Time Completed	3/20/01	
Drilling Company	Driller	Sampler(s)	Sampler Depth	
Tidewater, Inc.	Pete Miller		4 feet	
Drilling Equipment	Method	Elevation & Datum	Completion Depth	Rock Depth
Geoprobe 66DT	Direct-Push		26 feet bgs	NA
Bit Size	Core Barrel (s)	North Coordinate		
2 inch	4-foot soil core			
Geologist(s)		East Coordinate		
Matt Erbe / Brent Williams				

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	FID/PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
0	1	2.3	*		Fine to coarse SAND, moderate reddish brown (10 R 4/6) to very dark red (5 R 2/6), dry.	Soil color based on Munsell charts. USCS grain size classification. *PID reading not collected. See also the log for adjacent boring PO2-01 for lithology.
2						
4	2	1.7	>2000		Fine SAND, light brown (5 YR 5/6), some Silt, occasional coarse Sand, very moist.	
6						
8	3	0.0	*		Medium to coarse SAND, moderate yellowish brown, little Silt and fine Sand, very moist.	*PID reading not collected. Very loose. No recovery.
10					At 10 feet, dusky brown (5 YR 2/2) to grayish black (N2) staining, wet.	TCLP metals sample Total RCRA metals sample
12	4	3.0	>2000		Fine to coarse SAND, medium dark gray (N4), little fine subangular to subround Gravel, odor, wet.	
14	5	3.0	>2000		Recollected samples on 3/19/01 starting at 14 feet. Medium to coarse SAND, fining downward, dark gray staining, odor, wet.	
16						
18	6	4.0	>2000		Coarse SAND to fine GRAVEL, gray stained, wet.	PID < 20 ppm at bottom.

Signature:_____ Date:_____

Environmental Resources Management, Inc.
Boring Log

Boring Number:
PO2-19 / TMW-5 / TMW-5S

Site Name & Location MD Sand Gravel & Stone		Project Number 48410.01	Date & Time Started Date & Time Completed	3/13/01 3/20/01	
Drilling Company Tidewater, Inc.		Driller Pete Miller	Sampler(s)	Sampler Depth 4 feet	
Drilling Equipment Geoprobe 66DT		Method Direct-Push	Elevation & Datum	Completion Depth 26 feet bgs	Rock Depth NA
Bit Size 2 inch		Core Barrel (s) 4-foot soil core	North Coordinate		
Geologist(s) Matt Erbe / Brent Williams			East Coordinate		

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	FID/PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
20						Soil color based on Munsell charts. USCS grain size classification.
22	7	4.0	0		As above.	
24					At 24 feet, CLAY, moderate reddish orange (10 R 6/6) to grayish orange pink (10 R 8/2).	
26					End of boring at 26 feet bgs.	Temporary Well Installations TMW-5 Set 1-in PVC well at 22.5 feet bgs w/ 5 feet prepacked well screen Sand to 15 feet bgs Bentonite to 0 feet bgs TMW-5S Set 1-in PVC well at 13 feet bgs w/ 5 feet prepacked well screen Sand to 6 feet bgs Bentonite to 2 feet bgs
28						
30						
32						
34						
36						
38						

Signature:_____ Date:_____

Environmental Resources Management, Inc.
Boring Log

Boring Number:
BWA-23 / TMW-6 / TMW-6S

Site Name & Location MD Sand Gravel & Stone		Project Number 48410.01	Date & Time Started Date & Time Completed	3/13/01 3/13/01	
Drilling Company Tidewater, Inc.		Driller Pete Miller	Sampler(s)	Sampler Depth 4 feet	
Drilling Equipment Geoprobe 66DT		Method Direct-Push	Elevation & Datum	Completion Depth 27 feet bgs	Rock Depth NA
Bit Size 2 inch		Core Barrel (s) 4-foot soil core	North Coordinate		
Geologist(s) Matt Erbe / Brent Williams			East Coordinate		

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
0	1	2.7	0		*Fine SAND, light to moderate brown (5 YR 4/4),* little Silt, dry.	*Soil color based on Munsell charts.* USCS grain size classification. See also log for adjacent BWA-01
2					At 2.1 feet, Fine to medium SAND with pale orange (10 YR 8/2) Silt laminations, angular ironstone and round pebbles throughout, dark reddish brown (10 R 3/4) mottling, moist.	
4	2	4.0	1569		CLAY, light gray (N7), with medium Sand laminations, moderate yellowish brown (10 YR 5/4) with moderate reddish brown (10R 4/6) mottling, slight odor, dry.	
6						
8						
	3	0.6	35.1		As above.	
10						TCLP metals sample RCRA metals sample
12						
	4	3.0	1581		SILT, grayish orange pink (10 R 8/2), some Clay, trace fine Sand, moist.	
14					At 13.7 feet, very fine SAND and SILT, very pale orange (10 YR 8/2).	
16	5	4.0	>2000		As above to 17.5 feet, strong odor. Then fine SAND, very pale orange, some Silt. At 18.5 feet, 0.5 foot zone with beads of brown residual product.	
18						
					At 19 feet fine SAND, gray (N5), no evidence of product.	

Signature:_____ Date:_____

Environmental Resources Management, Inc.

Boring Log

Boring Number:
BWA-23 / TMW-6 / TMW-6S

Site Name & Location MD Sand Gravel & Stone	Project Number 48410.01	Date & Time Started Date & Time Completed	3/13/01 3/13/01
Drilling Company Tidewater, Inc.	Driller Pete Miller	Sampler(s)	Sampler Depth 4 feet
Drilling Equipment Geoprobe 66DT	Method Direct-Push	Elevation & Datum	Completion Depth: 27 feet bgs Rock Depth: NA
Bit Size 2 inch	Core Barrel (s) 4-foot soil core	North Coordinate	
Geologist(s) Matt Erbe / Brent Williams		East Coordinate	

DEPTH (ft below grade)	SAMPLES: Sample Number	Recovery (feet)	PID (ppm)	Lab Sample	SOIL DESCRIPTION	REMARKS
20	6	4.0	>2000		Medium SAND, light gray (N7), wet.	Soil color based on Munsell charts. USCS grain size classification.
22					At 21.4 feet very fine Silty SAND, light gray, brown residual product. At 22.7 feet Silty medium SAND, trace Clay, no evidence of residual product, strong odor.	
24	7	3.0	1029		SAND, very pale orange, several thin (0.25-in) Clayey Silt laminations throughout, occasional ironstone pebble, flat 2-in diameter, strong odor.	
26					At 26.5 feet grades to very fine SAND and SILT, moderate reddish brown. At 26.8 feet CLAY, moderate reddish brown, some very fine Sand and Silt laminations.	
28					End of boring at 27 feet bgs.	Temporary Well Installations TMW-6 Set 1-in PVC well at 25.4 feet bgs w/ 5 feet prepacked well screen Sand to 19.5 feet bgs Bentonite to 17 feet bgs TMW-6S Set 1-in PVC well at 16.9 feet bgs w/ 5 feet prepacked well screen Sand to 10 feet bgs Bentonite to 8 feet bgs
30						
32						
34						
36						
38						

Signature:_____ Date:_____

B

Appendix B
Sample Chain-of-Custody Forms and Laboratory Reports

MICROSEEPS

Project Number: 48410.01

MD Sand & Gravel

ERM's Contact: Mr. Matt Erbe/Jeff Flauzenbaum

Microseeps Contact: Becky Hans
May 15, 2001

220 William Pitt Way, Pittsburgh, PA 15238 • Phone (412) 826-5245, Fax (412) 826-3433

Microseeps
Case Narrative
for ERM
Project Name: Maryland Sand & Gravel
Project Number: 48410.01

Sample Receiving:

The following samples were received at Microseeps:

ERM Sample ID	Microseeps ID	Date Received
SMW-15	P0104059-01	4/4/01
SMW-17	P0104059-02	4/4/01
SMW-DUP	P0104059-03	4/4/01
SMW-12	P0104060-01	4/5/01
SMW-18A	P0104060-02	4/5/01
SMW-19A	P0104060-03	4/5/01
SMW-07	P0104060-04	4/5/01
SMW-2A	P0104088-01	4/6/01
TMW-6	P0104088-02	4/6/01
TMW-5	P0104088-03	4/6/01
SMW-13	P0104089-01	4/6/01
TMW-1	P0104114-01	4/9/01
TMW-2	P0104114-02	4/9/01
TMW-3	P0104114-03	4/9/01
TMW-4	P0104114-04	4/9/01
SMW-14	P0104114-05	4/9/01
SMW-15	P0104139-01	4/9/01
SMW-17	P0104139-02	4/9/01
SMW-DUP	P0104139-03	4/9/01
SMW-12	P0104139-04	4/9/01
SMW-07	P0104139-05	4/9/01
SMW-2A	P0104139-06	4/9/01
SMW-2A-D	P0104139-07	4/9/01
TMW-6	P0104139-08	4/9/01
TMW-5	P0104139-09	4/9/01
TMW-4	P0104139-10	4/9/01
SMW-14	P0104139-11	4/9/01

These samples were to be analyzed for Monitored Natural Attenuation analyses. The sample containers for the Dissolved Gases, Hydrogen, Light Hydrocarbons, and Permanent Gases, were sent separately from the other sample containers.

The following samples did not have bubble strip sample vials and only the Permanent Gases and Light Hydrocarbon analyses were performed from the water sample: SMW-18A, SMW-19A, SMW-13, TMW-1, and TMW-3. The bubble strip sample SMW-2A-2 was requested to be analyzed for dissolved Hydrogen.

A total metals bottle for sample TMW-2 was missing from a shipment received on 4/9/01. ERM's project manager, Matt Erbe, was contacted. He advised Microseeps to continue with all the other analyses requested for that sample.

Wet Chemistry

The percent recoveries of sample P0104060-02A MS/MSD, for Sulfate were below QC limits. The Sulfate concentration in the original sample was four times higher than the spike concentration.

The percent recoveries of sample P0104088-02A, and P0104114-04A MS/MSD, for Alkalinity were below QC limits. The alkalinity concentrations in the original samples were twice the spike concentration. The sample and duplicate concentrations were at the MDL, yielding poor RPD.

The percent recoveries of sample P0104114-02A MS/MSD, for Chloride were below QC limits. The Chloride concentrations in the original sample were four times the spike concentration.

Poor RPD between sample P0104114-03A and its duplicate was due to both results being below the MDL.

Poor RPD between sample P0104114-03A and its duplicate was due to both results being below the MDL.

All TOC and SOC samples were re-analyzed and the original results were confirmed by this reanalysis.

No other anomalies were reported.

Risk Analysis

No MS/MSD results are reported in this package. At this time, the laboratory does not perform MS/MSD's on bubble strip vapor samples.

No other anomalies were reported.

Metals Analysis

No anomalies were reported for these analyses.

Analytical Data

MICROSEEPS

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Sample Identification

Lab Sample #	Client Sample ID
P0104059-01	SMW-15
P0104059-02	SMW-17
P0104059-03	SMW-DUP

Approved By: Rebecca J. Adams

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104059-01

Sample Description	Matrix	Sampled Date/Time	Received
SMW-15	Water	03 Apr. 01 11:05	04 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
NetChem				
Alkalinity as CaCO3	<4	4	mg/L	310.1
Chloride	79	1	mg/L	9056
Ferrous Iron	< 1.0	1	mg/L	Mod._7199
Nitrate	22	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	18	2	mg/L	9060
Sulfate	20	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	<0.050	0.050	mg/L	6010B
Manganese-dissolved	0.067	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104059-02

Sample Description	Matrix	Sampled Date/Time	Received
SMW-17	Water	03 Apr. 01 15:40	04 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	200	4	mg/L	310.1
Chloride	9.4	1	mg/L	9056
Ferrous Iron	1.8	1	mg/L	Mod._7199
Nitrate	0.24	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	11	2	mg/L	9060
Sulfate	14	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	2.3	2	mg/L	9060
Metals				
Iron	4.3	0.050	mg/L	6010B
Manganese-dissolved	0.77	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104059-03

Sample Description	Matrix	Sampled Date/Time	Received
SMW-DUP	Water	03 Apr. 01 8:00	04 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	<4	4	mg/L	310.1
Chloride	78	1	mg/L	9056
Ferrous Iron	< 1.0	1	mg/L	Mod._7199
Nitrate	22	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	< 2.0	2	mg/L	9060
Sulfate	19	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	<2	2	mg/L	9060
Metals				
Iron	<0.050	0.050	mg/L	6010B
Manganese-dissolved	0.066	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for t
Analysis Method: Dissolved TAL Metals by Inductively Coupled Plasma

M010430031-MB

	Result	RDL	%Recovery	Ctl Limits
Manganese-dissolved	0.0001	0.010		- NA

M010430031-LCS

	%Recovery	Ctl Limits
Manganese-dissolved	96	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Manganese-dissolved		- NA	1.50	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Manganese-dissolved	95	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for I
Analysis Method: Inductively Coupled Plasma-Atomic Emission Spectro

M010430032-MB

	Result	RDL	%Recovery	Ctl Limits
Iron	0.015	0.050		- NA

M010430032-LCS

	%Recovery	Ctl Limits
Iron	106	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Iron		- NA	20.41	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Iron	98	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M010502027-MB

	Result	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	0.1	4.0		- NA

M010502027-LCS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	101	80 - 120

P0104059-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104059-03A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	98	75 - 125

P0104059-03A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	96	75 - 125	2.02	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Titrametric Iodine
Analysis Method: Titrametric Iodine

M010502032-MB

	Result	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	2.0		- NA

M010502032-LCS

	%Recovery	Ctl Limits
Sulfide	68	50 - 75

P0104060-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide		- NA	0.00	0 - 20

P0104060-02A-MS

	%Recovery	Ctl Limits
Sulfide	71	50 - 75

P0104060-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	71	50 - 75	0.00	0 - 20

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M010502034-MB

	Result	RDL	%Recovery	Ctl Limits
Chloride	< 1.0	1		- NA
Nitrite	< 0.10	0.10000		- NA
Nitrate	< 0.10	0.10000		- NA
Sulfate	< 1.0	1		- NA

M010502034-LCS

	%Recovery	Ctl Limits
Chloride	100	80 - 120
Nitrite	98	80 - 120
Nitrate	98	80 - 120
Sulfate	96	80 - 120

P0104060-02A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride		- NA	0.00	0 - 20
Nitrite		- NA	0.00	0 - 20
Nitrate		- NA	0.00	0 - 20
Sulfate		- NA	2.74	0 - 20

P0104060-02A-MS

	%Recovery	Ctl Limits
Chloride	111	75 - 125
Nitrite	96	75 - 125
Nitrate	102	75 - 125
Sulfate	50	75 - 125

P0104060-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	101	75 - 125	6.06	0 - 20
Nitrite	97	75 - 125	1.04	0 - 20
Nitrate	92	75 - 125	7.41	0 - 20
Sulfate	50	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Mod. for Determination of Ferrous and Ferric
Analysis Method: Mod. for Determination of Ferrous and Ferric

M010503051-MB

	Result	RDL	%Recovery	Ctl Limits
Ferrous Iron	< 1.0	1.0		- NA

M010503051-LCS

	%Recovery	Ctl Limits
Ferrous Iron	100	80 - 120

P0104060-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron		- NA	0.00	0 - 20

P0104060-01A-MS

	%Recovery	Ctl Limits
Ferrous Iron	110	75 - 125

P0104060-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron	110	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M010503059-MB

	Result	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 2.0	2.0		- NA

M010503059-LCS

	%Recovery	Ctl Limits
Total Organic Carbon	108	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon		- NA	0.00	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Total Organic Carbon	120	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	120	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Soluble Organic Carbon
Analysis Method: Soluble Organic Carbon

M010503061-MB

	Result	RDL	%Recovery	Ctl Limits
SolubleOrganic Carbon	< 2.0	2.0		- NA

M010503061-LCS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	106	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon		- NA	18.18	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	90	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon	90	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104059
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Case Narrative:CLIENT ADVISED BJH THAT THEY WILL SEND THEIR H2 VIALS FOR THIS PROJECT ALL AT ONCE. LOGGED IN REST OF PARAMETERS AS PER QUOTE.(CW 4-5-01) The TOC and SOC results have been reanalyzed and confirmed. See case narrative.

MICROSEEPS

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Page: Page 1 of 17
Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Sample Identification

Lab Sample #	Client Sample ID
P0104060-01	SMW-12
P0104060-02	SMW-18A
P0104060-03	SMW-19A
P0104060-04	SMW-07

Approved By: Rebecca J. Adams

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104060-01

Sample Description	Matrix	Sampled Date/Time	Received
SMW-12	Water	04 Apr. 01 8:40	05 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	50	4	mg/L	310.1
Chloride	14	1	mg/L	9056
Ferrous Iron	10	1	mg/L	Mod._7199
Nitrate	< 0.10	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	<2	2	mg/L	9060
Sulfate	40	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	14	0.050	mg/L	6010B
Manganese-dissolved	0.20	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104060-02

Sample Description	Matrix	Sampled Date/Time	Received
SMW-18A	Water	04 Apr. 01 11:00	05 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	<4	4	mg/L	310.1
Chloride	5.9	1	mg/L	9056
Ferrous Iron	<1	1	mg/L	Mod._7199
Nitrate	3.8	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	<2	2	mg/L	9060
Sulfate	36	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	0.99	0.050	mg/L	6010B
Manganese-dissolved	0.12	0.010	mg/L	
RiskAnalysis				
Carbon dioxide	62	0.60	mg/L	AM15
Carbon monoxide	< 0.40	0.40	mg/L	
Ethane	170	5.0	ng/L	AM18
Ethene	170	5.0	ng/L	
Methane	1.8	0.015	ug/L	
Nitrogen	21	0.40	mg/L	AM15
Oxygen	9.4	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
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Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104060-03

Sample Description	Matrix	Sampled Date/Time	Received
SMW-19A	Water	04 Apr. 01 12:55	05 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	6.0	4	mg/L	310.1
Chloride	20	1	mg/L	9056
Ferrous Iron	1.6	1	mg/L	Mod._7199
Nitrate	< 0.10	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	< 2.0	2	mg/L	9060
Sulfate	13	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	6.5	0.050	mg/L	6010B
Manganese-dissolved	0.11	0.010	mg/L	
RiskAnalysis				
Carbon dioxide	56	0.60	mg/L	AM15
Carbon monoxide	< 0.40	0.40	mg/L	
Ethane	1800	5.0	ng/L	AM18
Ethene	63000	5.0	ng/L	
Methane	14	0.015	ug/L	
Nitrogen	24	0.40	mg/L	AM15
Oxygen	2.6	0.15	mg/L	

Client Name: ERM, Inc
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Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104060-04

Sample Description	Matrix	Sampled Date/Time	Received
SMW-07	Water	04 Apr. 01 15:05	05 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
NetChem				
Alkalinity as CaCO3	54	4	mg/L	310.1
Chloride	40	1	mg/L	9056
Ferrous Iron	88	1	mg/L	Mod._7199
Nitrate	< 0.10	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	9.9	2	mg/L	9060
Sulfate	< 1.0	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	9.1	2	mg/L	9060
Metals				
Iron	71	0.050	mg/L	6010B
Manganese-dissolved	0.16	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of C1-C4 Hydrocarbons in Water
Analysis Method: Analysis of C1-C4 Hydrocarbons in Water

M010417017-MB

	Result	RDL	%Recovery	Ctl Limits
Ethene	< 5.0	5.0		- NA
Ethane	< 5.0	5.0		- NA

M010417017-LCS

	%Recovery	Ctl Limits
Ethene	99	70 - 130
Ethane	100	70 - 130

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of Dissolved Methane in Water
Analysis Method: Analysis of Dissolved Methane in Water

M010417018-MB

	Result	RDL	%Recovery	Ctl Limits
Methane	< 0.015	0.015		- NA

M010417018-LCS

	%Recovery	Ctl Limits
Methane	98	70 - 130

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
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Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M010417019-MB

	Result	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	0.60		- NA
Oxygen	< 0.15	0.15		- NA
Nitrogen	< 0.40	0.40		- NA
Carbon monoxide	< 0.40	0.40		- NA

M010417019-LCS

	%Recovery	Ctl Limits
Carbon dioxide	94	70 - 130
Oxygen	99	70 - 130

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for I
Analysis Method: Dissiolved TAL Metals by Inductively Coupled Plasma

M010430031-MB

	Result	RDL	%Recovery	Ctl Limits		
Manganese-dissolved	0.0001	0.010		- NA		

M010430031-LCS

	%Recovery	Ctl Limits
Manganese-dissolved	96	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Manganese-dissolved		- NA	1.50	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Manganese-dissolved	95	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for
Analysis Method: Inductively Coupled Plasma-Atomic Emission Spectro

M010430032-MB

	Result	RDL	%Recovery	Ctl Limits
Iron	0.015	0.050		- NA

M010430032-LCS

	%Recovery	Ctl Limits
Iron	106	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Iron		- NA	20.41	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Iron	98	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M010502027-MB

	Result	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	0.1	4.0		- NA

M010502027-LCS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	101	80 - 120

P0104059-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104059-03A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	98	75 - 125

P0104059-03A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	96	75 - 125	2.02	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Titrametric Iodine
Analysis Method: Titrametric Iodine

M010502032-MB

	Result	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	2.0		- NA

M010502032-LCS

	%Recovery	Ctl Limits
Sulfide	68	50 - 75

P0104060-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide		- NA	0.00	0 - 20

P0104060-02A-MS

	%Recovery	Ctl Limits
Sulfide	71	50 - 75

P0104060-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide	71	50 - 75	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M010502034-MB

	Result	RDL	%Recovery	Ctl Limits
Chloride	< 1.0	1		- NA
Nitrite	< 0.10	0.10000		- NA
Nitrate	< 0.10	0.10000		- NA
Sulfate	< 1.0	1		- NA

M010502034-LCS

	%Recovery	Ctl Limits
Chloride	100	80 - 120
Nitrite	98	80 - 120
Nitrate	98	80 - 120
Sulfate	96	80 - 120

P0104060-02A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride		- NA	0.00	0 - 20
Nitrite		- NA	0.00	0 - 20
Nitrate		- NA	0.00	0 - 20
Sulfate		- NA	2.74	0 - 20

P0104060-02A-MS

	%Recovery	Ctl Limits
Chloride	111	75 - 125
Nitrite	96	75 - 125
Nitrate	102	75 - 125
Sulfate	50	75 - 125

P0104060-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	101	75 - 125	6.06	0 - 20
Nitrite	97	75 - 125	1.04	0 - 20
Nitrate	92	75 - 125	7.41	0 - 20
Sulfate	50	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Mod. for Determination of Ferrous and Ferric
Analysis Method: Mod. for Determination of Ferrous and Ferric

M010503051-MB

	Result	RDL	%Recovery	Ctl Limits
Ferrous Iron	< 1.0	1.0		- NA

M010503051-LCS

	%Recovery	Ctl Limits
Ferrous Iron	100	80 - 120

P0104060-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron		- NA	0.00	0 - 20

P0104060-01A-MS

	%Recovery	Ctl Limits
Ferrous Iron	110	75 - 125

P0104060-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron	110	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M010503059-MB

	Result	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 2.0	2.0		- NA

M010503059-LCS

	%Recovery	Ctl Limits
Total Organic Carbon	108	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon		- NA	0.00	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Total Organic Carbon	120	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	120	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Soluble Organic Carbon
Analysis Method: Soluble Organic Carbon

M010503061-MB

	Result	RDL	%Recovery	Ctl Limits
SolubleOrganic Carbon	< 2.0	2.0		- NA

M010503061-LCS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	106	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon		- NA	18.18	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	90	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon	90	75 - 125	0.00	0 - 20

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104060
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Case Narrative:CLIENT ADVISED BJH THAT THEY WILL SEND THEIR H2 VIALS FOR THIS PROJECT ALL AT ONCE. LOGGED IN REST OF PARAMETERS AS PER QUOTE.(CW 4-5-01) The TOC and SOC results have been reanalyzed and confirmed. See attached case narrative.

MICROSEEPS

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Sample Identification

Lab Sample #	Client Sample ID
P0104088-01	SMW-2A
P0104088-02	TMW-6
P0104088-03	TMW-5

Approved By: Rebecca J. Adams

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104088-01

Sample Description	Matrix	Sampled Date/Time	Received
SMW-2A	Water	05 Apr. 01 8:55	06 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	< 4.0	4	mg/L	310.1
Chloride	3.0	1	mg/L	9056
Ferrous Iron	< 1.0	1	mg/L	Mod._7199
Nitrate	< 0.10	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	6.6	2	mg/L	9060
Sulfate	11	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	<2	2	mg/L	9060
Metals				
Iron	0.56	0.050	mg/L	6010B
Manganese-dissolved	0.021	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104088-02

Sample Description	Matrix	Sampled Date/Time	Received
TMW-6	Water	05 Apr. 01 13:30	06 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	140	4	mg/L	310.1
Chloride	27	1	mg/L	9056
Ferrous Iron	72	1	mg/L	Mod._7199
Nitrate	< 0.10	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	3.8	2	mg/L	9060
Sulfate	< 1.0	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	4.2	2	mg/L	9060
Metals				
Iron	57	0.050	mg/L	6010B
Manganese-dissolved	0.24	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104088-03

Sample Description	Matrix	Sampled Date/Time	Received
TMW-5	Water	05 Apr. 01 15:15	06 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	110	4	mg/L	310.1
Chloride	37	1	mg/L	9056
Ferrous Iron	88	1	mg/L	Mod._7199
Nitrate	< 0.10	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	30	2	mg/L	9060
Sulfate	< 1.0	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	30	2	mg/L	9060
Metals				
Iron	74	0.050	mg/L	6010B
Manganese-dissolved	0.34	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for
Analysis Method: Disslolved TAL Metals by Inductively Coupled Plasm

M010430031-MB

	Result	RDL	%Recovery	Ctl Limits
Manganese-dissolved	0.0001	0.010		- NA

M010430031-LCS

	%Recovery	Ctl Limits
Manganese-dissolved	96	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Manganese-dissolved		- NA	1.50	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Manganese-dissolved	95	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for t
Analysis Method: Inductively Coupled Plasma-Atomic Emission Spectro.

M010430032-MB

	Result	RDL	%Recovery	Ctl Limits
Iron	0.015	0.050		- NA

M010430032-LCS

	%Recovery	Ctl Limits
Iron	106	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Iron		- NA	20.41	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Iron	98	75 - 125

[ ] Outlined Results indicate results outside of Control limits

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Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M010502031-MB

	Result	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	< 4.0	4.0		- NA

M010502031-LCS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	114	80 - 120

P0104088-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104089-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	28.57	0 - 20

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104088-02A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	50	75 - 125

P0104089-01A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	90	75 - 125

P0104114-04A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	48	75 - 125

P0104088-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	40	75 - 125	5.41	0 - 20

P0104114-04A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	46	75 - 125	2.82	0 - 20

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Titrametric Iodine
Analysis Method: Titrametric Iodine

M010502033-MB

	Result	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	2.0		- NA

M010502033-LCS

	%Recovery	Ctl Limits
Sulfide	71	50 - 75

P0104088-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide		- NA	0.00	0 - 20

P0104088-01A-MS

	%Recovery	Ctl Limits
Sulfide	74	50 - 75

[ ] Outlined Results indicate results outside of Control limits

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Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Anions by Ion chromatography
Analysis Method: Anions by Ion chromatography

M010502034-MB

	Result	RDL	%Recovery	Ctl Limits
Chloride	< 1.0	1		- NA
Nitrite	< 0.10	0.10000		- NA
Nitrate	< 0.10	0.10000		- NA
Sulfate	< 1.0	1		- NA

M010502034-LCS

	%Recovery	Ctl Limits
Chloride	100	80 - 120
Nitrite	98	80 - 120
Nitrate	98	80 - 120
Sulfate	96	80 - 120

P0104060-02A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride		- NA	0.00	0 - 20
Nitrite		- NA	0.00	0 - 20
Nitrate		- NA	0.00	0 - 20
Sulfate		- NA	2.74	0 - 20

P0104060-02A-MS

	%Recovery	Ctl Limits
Chloride	111	75 - 125
Nitrite	96	75 - 125
Nitrate	102	75 - 125
Sulfate	50	75 - 125

P0104060-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	101	75 - 125	6.06	0 - 20
Nitrite	97	75 - 125	1.04	0 - 20
Nitrate	92	75 - 125	7.41	0 - 20
Sulfate	50	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

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Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Mod. for Determination of Ferrous and Ferric
Analysis Method: Mod. for Determination of Ferrous and Ferric

M010503051-MB

	Result	RDL	%Recovery	Ctl Limits
Ferrous Iron	< 1.0	1.0		- NA

M010503051-LCS

	%Recovery	Ctl Limits
Ferrous Iron	100	80 - 120

P0104060-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron		- NA	0.00	0 - 20

P0104060-01A-MS

	%Recovery	Ctl Limits
Ferrous Iron	110	75 - 125

P0104060-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron	110	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M010503059-MB

	Result	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 2.0	2.0		- NA

M010503059-LCS

	%Recovery	Ctl Limits
Total Organic Carbon	108	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon		- NA	0.00	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Total Organic Carbon	120	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	120	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

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Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Soluble Organic Carbon
Analysis Method: Soluble Organic Carbon

M010503061-MB

	Result	RDL	%Recovery	Ctl Limits
SolubleOrganic Carbon	< 2.0	2.0		- NA

M010503061-LCS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	106	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon		- NA	18.18	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	90	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon	90	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

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Annapolis, MD 21401

Lab Project #: P0104088
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Case Narrative:CLIENT ADVISED BJH THAT THEY WILL SEND THEIR H2 VIALS FOR THIS PROJECT ALL AT ONCE. LOGGED IN REST OF PARAMETERS AS PER QUOTE.(CW 4-6-01) The TOC and SOC results have been reanalyzed and confirmed. See attached case narrative.

MICROSEEPS

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Page: Page 1 of 14
Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Sample Identification

Lab Sample #	Client Sample ID
P0104089-01	SMW-13

Approved By: Rebecca J. Hans

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104089-01

Sample Description	Matrix	Sampled Date/Time	Received
SMW-13	Water	05 Apr. 01 0:00	06 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	6.0	4	mg/L	310.1
Chloride	3.5	1	mg/L	9056
Ferrous Iron	< 1.0	1	mg/L	Mod._7199
Nitrate	0.50	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	7.6	2	mg/L	9060
Sulfate	25	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	<0.050	0.050	mg/L	6010B
Manganese-dissolved	0.10	0.010	mg/L	
RiskAnalysis				
Carbon dioxide	28	0.60	mg/L	AM15
Carbon monoxide	< 0.40	0.40	mg/L	
Ethane	110	5.0	ng/L	AM18
Ethene	92	5.0	ng/L	
Methane	0.11	0.015	ug/L	
Nitrogen	19	0.40	mg/L	AM15
Oxygen	11	0.15	mg/L	

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Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of C1-C4 Hydrocarbons in Water
Analysis Method: Analysis of C1-C4 Hydrocarbons in Water

M010418002-MB

	Result	RDL	%Recovery	Ctl Limits
Ethene	< 5.0	5.0		- NA
Ethane	< 5.0	5.0		- NA

M010418002-LCS

	%Recovery	Ctl Limits
Ethene	98	70 - 130
Ethane	98	70 - 130

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of Dissolved Methane in Water
Analysis Method: Analysis of Dissolved Methane in Water

M010418003-MB

	Result	RDL	%Recovery	Ctl Limits
Methane	< 0.015	0.015		- NA

M010418003-LCS

	%Recovery	Ctl Limits
Methane	98	70 - 130

P0104064-02A-MS

	%Recovery	Ctl Limits
Methane	91	70 - 130

P0104064-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Methane	92	70 - 130	1.55	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M010418004-MB

	Result	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	0.60		- NA
Oxygen	< 0.15	0.15		- NA
Nitrogen	< 0.40	0.40		- NA
Carbon monoxide	< 0.40	0.40		- NA

M010418004-LCS

	%Recovery	Ctl Limits
Carbon dioxide	89	70 - 130
Oxygen	91	70 - 130

P0104064-02A-MS

	%Recovery	Ctl Limits
Carbon dioxide	0	70 - 130
Oxygen	55	70 - 130

P0104064-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Carbon dioxide	0	70 - 130	0.00	0 - 20
Oxygen	55	70 - 130	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for t
Analysis Method: Dissiolved TAL Metals by Inductively Coupled Plasma

M010430033-MB

	Result	RDL	%Recovery	Ctl Limits
Manganese-dissolved	< 0.010	0.010		- NA

M010430033-LCS

	%Recovery	Ctl Limits
Manganese-dissolved	96	80 - 120

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Manganese-dissolved		- NA	6.45	0 - 20

P0104114-04A-MS

	%Recovery	Ctl Limits
Manganese-dissolved	96	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Page: Page 7 of 14
Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for t
Analysis Method: Inductively Coupled Plasma-Atomic Emission Spectro

M010430034-MB

	Result	RDL	%Recovery	Ctl Limits
Iron	0.018	0.050		- NA

M010430034-LCS

	%Recovery	Ctl Limits
Iron	104	80 - 120

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Iron		- NA	10.00	0 - 20

P0104114-04A-MS

	%Recovery	Ctl Limits
Iron	-200	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

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Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M010502031-MB

	Result	RDL	%Recovery	Ctl Limits		
Alkalinity as CaCO3	< 4.0	4.0		- NA		

M010502031-LCS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	114	80 - 120

P0104088-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104089-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	28.57	0 - 20

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104088-02A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	50	75 - 125

P0104089-01A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	90	75 - 125

P0104114-04A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	48	75 - 125

P0104088-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	40	75 - 125	5.41	0 - 20

P0104114-04A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	46	75 - 125	2.82	0 - 20

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Titrametric Iodine
Analysis Method: Titrametric Iodine

M010502033-MB

	Result	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	2.0		- NA

M010502033-LCS

	%Recovery	Ctl Limits
Sulfide	71	50 - 75

P0104088-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide		- NA	0.00	0 - 20

P0104088-01A-MS

	%Recovery	Ctl Limits
Sulfide	74	50 - 75

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
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Page: Page 10 of 14
Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M010502034-MB

	Result	RDL	%Recovery	Ctl Limits
Chloride	< 1.0	1		- NA
Nitrite	< 0.10	0.10000		- NA
Nitrate	< 0.10	0.10000		- NA
Sulfate	< 1.0	1		- NA

M010502034-LCS

	%Recovery	Ctl Limits
Chloride	100	80 - 120
Nitrite	98	80 - 120
Nitrate	98	80 - 120
Sulfate	96	80 - 120

P0104060-02A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride		- NA	0.00	0 - 20
Nitrite		- NA	0.00	0 - 20
Nitrate		- NA	0.00	0 - 20
Sulfate		- NA	2.74	0 - 20

P0104060-02A-MS

	%Recovery	Ctl Limits
Chloride	111	75 - 125
Nitrite	96	75 - 125
Nitrate	102	75 - 125
Sulfate	50	75 - 125

P0104060-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	101	75 - 125	6.06	0 - 20
Nitrite	97	75 - 125	1.04	0 - 20
Nitrate	92	75 - 125	7.41	0 - 20
Sulfate	50	75 - 125	0.00	0 - 20

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Mod. for Determination of Ferrous and Ferric
Analysis Method: Mod. for Determination of Ferrous and Ferric

M010503051-MB

	Result	RDL	%Recovery	Ctl Limits
Ferrous Iron	< 1.0	1.0		- NA

M010503051-LCS

	%Recovery	Ctl Limits
Ferrous Iron	100	80 - 120

P0104060-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron		- NA	0.00	0 - 20

P0104060-01A-MS

	%Recovery	Ctl Limits
Ferrous Iron	110	75 - 125

P0104060-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron	110	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M010503059-MB

	Result	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 2.0	2.0		- NA

M010503059-LCS

	%Recovery	Ctl Limits
Total Organic Carbon	108	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon		- NA	0.00	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
Total Organic Carbon	120	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	120	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Soluble Organic Carbon
Analysis Method: Soluble Organic Carbon

M010503061-MB

	Result	RDL	%Recovery	Ctl Limits
SolubleOrganic Carbon	< 2.0	2.0		- NA

M010503061-LCS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	106	80 - 120

P0104059-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon		- NA	18.18	0 - 20

P0104059-01A-MS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	90	75 - 125

P0104059-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon	90	75 - 125	0.00	0 - 20

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Annapolis, MD 21401

Lab Project #: P0104089
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Case Narrative:The TOC and SOC results have been reanalyzed and confirmed. See attached case narrative.

MICROSEEPS

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

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Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Sample Identification

Lab Sample #	Client Sample ID
P0104114-01	TMW-1
P0104114-02	TMW-2
P0104114-03	TMW-3
P0104114-04	TMW-4
P0104114-05	SMW-14

Approved By: Rebecca J. Adams

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104114-01

Sample Description	Matrix	Sampled Date/Time	Received
TMW-1	Water	06 Apr. 01 10:25	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Chloride	58	1.0	mg/L	9056
Nitrate	8.3	0.10	mg/L	
Nitrite	0.73	0.10	mg/L	
Sulfate	4.7	1.0	mg/L	
RiskAnalysis				
Carbon dioxide	47	0.60	mg/L	AM15
Carbon monoxide	< 0.40	0.40	mg/L	
Ethane	11000	5.0	ng/L	AM18
Ethene	6000	5.0	ng/L	
Methane	8.2	0.015	ug/L	
Nitrogen	17	0.40	mg/L	AM15
Oxygen	4.0	0.15	mg/L	

Client Name: ERM, Inc
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Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104114-02

Sample Description	Matrix	Sampled Date/Time	Received
TMW-2	Water	06 Apr. 01 12:35	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
NetChem				
Chloride	43	1	mg/L	9056
Nitrate	8.4	0.10	mg/L	
Nitrite	< 0.10	0.10	mg/L	
Sulfate	1.7	1	mg/L	
RiskAnalysis				
Carbon dioxide	62	0.60	mg/L	AM15
Carbon monoxide	< 0.40	0.40	mg/L	
Ethane	1400	5.0	ng/L	AM18
Ethene	800	5.0	ng/L	
Methane	2.1	0.015	ug/L	
Nitrogen	18	0.40	mg/L	AM15
Oxygen	7.5	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104114-03

Sample Description	Matrix	Sampled Date/Time	Received
TMW-3	Water	06 Apr. 01 14:20	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	<4	4	mg/L	310.1
Chloride	4.1	1	mg/L	9056
Ferrous Iron	<1	1	mg/L	Mod._7199
Nitrate	1.4	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	< 2.0	2	mg/L	9060
Sulfate	12	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	0.19	0.050	mg/L	6010B
Manganese-dissolved	0.15	0.010	mg/L	
RIskAnalysis				
Carbon dioxide	120	0.60	mg/L	AM15
Carbon monoxide	< 0.40	0.40	mg/L	
Ethane	210	5.0	ng/L	AM18
Ethene	130	5.0	ng/L	
Methane	8.8	0.015	ug/L	
Nitrogen	20	0.40	mg/L	AM15
Oxygen	7.5	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104114-04

Sample Description	Matrix	Sampled Date/Time	Received
TMW-4	Water	06 Apr. 01 16:45	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	24	4	mg/L	310.1
Chloride	16	1	mg/L	9056
Ferrous Iron	25	1	mg/L	Mod._7199
Nitrate	0.24	0.10	mg/L	9056
Nitrite	< 0.10	0.10	mg/L	
SolubleOrganic Carbon	< 2.0	2	mg/L	9060
Sulfate	16	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	28	0.050	mg/L	6010B
Manganese-dissolved	0.10	0.010	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104114-05

Sample Description	Matrix	Sampled Date/Time	Received
SMW-14	Water	06 Apr. 01 18:00	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
WetChem				
Alkalinity as CaCO3	12	4	mg/L	310.1
Chloride	5.6	1	mg/L	9056
Ferrous Iron	< 1.0	1	mg/L	Mod._7199
Nitrate	0.42	0.10000	mg/L	9056
Nitrite	< 0.10	0.10000	mg/L	
SolubleOrganic Carbon	6.2	2	mg/L	9060
Sulfate	8.1	1	mg/L	9056
Sulfide	< 2.0	2	mg/L	376.1
Total Organic Carbon	< 2.0	2	mg/L	9060
Metals				
Iron	0.074	0.05000	mg/L	6010B
Manganese-dissolved	0.031	0.01000	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M010412033-MB

	Result	RDL	%Recovery	Ctl Limits
Chloride	< 1.0	1.0		- NA
Nitrite	< 0.10	0.10		- NA
Nitrate	< 0.10	0.10		- NA
Sulfate	< 1.0	1.0		- NA

M010412033-LCS

	%Recovery	Ctl Limits

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of C1-C4 Hydrocarbons in Water
Analysis Method: Analysis of C1-C4 Hydrocarbons in Water

M010419001-MB

	Result	RDL	%Recovery	Ctl Limits
Ethene	< 5.0	5.0		- NA
Ethane	< 5.0	5.0		- NA

M010419001-LCS

	%Recovery	Ctl Limits
Ethene	98	70 - 130
Ethane	98	70 - 130

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of Dissolved Methane in Water
Analysis Method: Analysis of Dissolved Methane in Water

M010419002-MB

	Result	RDL	%Recovery	Ctl Limits
Methane	< 0.015	0.015		- NA

M010419002-LCS

	%Recovery	Ctl Limits
Methane	97	70 - 130

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Analysis of Dissolved Permanent Gases in Water
Analysis Method: Analysis of Dissolved Permanent Gases in Water

M010419003-MB

	Result	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	0.60		- NA
Oxygen	< 0.15	0.15		- NA
Nitrogen	< 0.40	0.40		- NA
Carbon monoxide	< 0.40	0.40		- NA

M010419003-LCS

	%Recovery	Ctl Limits
Carbon dioxide	94	70 - 130
Oxygen	95	70 - 130

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for
Analysis Method: Disslolved TAL Metals by Inductively Coupled Plasma

M010430033-MB

	Result	RDL	%Recovery	Ctl Limits
Manganese-dissolved	< 0.010	0.010		- NA

M010430033-LCS

	%Recovery	Ctl Limits
Manganese-dissolved	96	80 - 120

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Manganese-dissolved		- NA	6.45	0 - 20

P0104114-04A-MS

	%Recovery	Ctl Limits
Manganese-dissolved	96	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Acid Digestions of Aqueous samples and extracts for
Analysis Method: Inductively Coupled Plasma-Atomic Emission Spectro

M010430034-MB

	Result	RDL	%Recovery	Ctl Limits
Iron	0.018	0.050		- NA

M010430034-LCS

	%Recovery	Ctl Limits
Iron	104	80 - 120

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Iron		- NA	10.00	0 - 20

P0104114-04A-MS

	%Recovery	Ctl Limits
Iron	-200	75 - 125

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Alkalinity Titrametric
Analysis Method: Alkalinity Titrametric

M010502031-MB

	Result	RDL	%Recovery	Ctl Limits
Alkalinity as CaCO3	< 4.0	4.0		- NA

M010502031-LCS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	114	80 - 120

P0104088-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104089-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	28.57	0 - 20

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3		- NA	0.00	0 - 20

P0104088-02A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	50	75 - 125

P0104089-01A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	90	75 - 125

P0104114-04A-MS

	%Recovery	Ctl Limits
Alkalinity as CaCO3	48	75 - 125

P0104088-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	40	75 - 125	5.41	0 - 20

P0104114-04A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Alkalinity as CaCO3	46	75 - 125	2.82	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
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Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Titrametric Iodine
Analysis Method: Titrametric Iodine

M010502033-MB

	Result	RDL	%Recovery	Ctl Limits
Sulfide	< 2.0	2.0		- NA

M010502033-LCS

	%Recovery	Ctl Limits
Sulfide	71	50 - 75

P0104088-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Sulfide		- NA	0.00	0 - 20

P0104088-01A-MS

	%Recovery	Ctl Limits
Sulfide	74	50 - 75

[ ] *Outlined Results indicate results outside of Control limits*

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Anions by ion chromatography
Analysis Method: Anions by ion chromatography

M010503018-MB

	Result	RDL	%Recovery	Ctl Limits
Chloride	< 1.0	1.0		- NA
Nitrite	< 0.10	0.10		- NA
Nitrate	< 0.10	0.10		- NA
Sulfate	< 1.0	1.0		- NA

M010503018-LCS

	%Recovery	Ctl Limits
Chloride	100	80 - 120
Nitrite	99	80 - 120
Nitrate	100	80 - 120
Sulfate	100	80 - 120

P0104114-02A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride		- NA	2.35	0 - 20
Nitrite		- NA	0.00	0 - 20
Nitrate		- NA	0.00	0 - 20
Sulfate		- NA	34.48	0 - 20

P0104165-01A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride		- NA	6.19	0 - 20
Nitrite		- NA	0.00	0 - 20
Nitrate		- NA	0.00	0 - 20
Sulfate		- NA	0.00	0 - 20

P0104114-02A-MS

	%Recovery	Ctl Limits
Chloride	0	75 - 125
Nitrite	95	75 - 125
Nitrate	86	75 - 125
Sulfate	113	75 - 125

P0104165-01A-MS

	%Recovery	Ctl Limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

P0104165-01A-MS

	%Recovery	Ctl Limits
Chloride	90	75 - 125
Nitrite	98	75 - 125
Nitrate	100	75 - 125
Sulfate	0	75 - 125

P0104114-02A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	10	75 - 125	2.30	0 - 20
Nitrite	97	75 - 125	2.08	0 - 20
Nitrate	86	75 - 125	0.00	0 - 20
Sulfate	113	75 - 125	0.00	0 - 20

P0104165-01A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Chloride	90	75 - 125	0.00	0 - 20
Nitrite	99	75 - 125	1.02	0 - 20
Nitrate	100	75 - 125	0.00	0 - 20
Sulfate	0	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
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Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Mod. for Determination of Ferrous and Ferric
Analysis Method: Mod. for Determination of Ferrous and Ferric

M010503050-MB

	Result	RDL	%Recovery	Ctl Limits		
Ferrous Iron	< 1.0	1.0		- NA		

M010503050-LCS

	%Recovery	Ctl Limits
Ferrous Iron	100	80 - 120

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron		- NA	200.00	0 - 20

P0104118-06A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron		- NA	2.20	0 - 20

P0104114-03A-MS

	%Recovery	Ctl Limits
Ferrous Iron	104	75 - 125

P0104118-06A-MS

	%Recovery	Ctl Limits
Ferrous Iron	110	75 - 125

P0104114-03A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron	104	75 - 125	0.00	0 - 20

P0104118-06A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Ferrous Iron	110	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Total Organic Carbon
Analysis Method: Total Organic Carbon

M010503060-MB

	Result	RDL	%Recovery	Ctl Limits
Total Organic Carbon	< 2.0	2.0		- NA

M010503060-LCS

	%Recovery	Ctl Limits
Total Organic Carbon	110	80 - 120

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon		- NA	0.00	0 - 20

P0104114-03A-MS

	%Recovery	Ctl Limits
Total Organic Carbon	105	75 - 125

P0104114-03A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
Total Organic Carbon	115	75 - 125	9.09	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Soluble Organic Carbon
Analysis Method: Soluble Organic Carbon

M010503062-MB

	Result	RDL	%Recovery	Ctl Limits
SolubleOrganic Carbon	< 2.0	2.0		- NA

M010503062-LCS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	110	80 - 120

P0104114-03A-DUP

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon		- NA	200.00	0 - 20

P0104114-03A-MS

	%Recovery	Ctl Limits
SolubleOrganic Carbon	100	75 - 125

P0104114-03A-MSD

	%Recovery	Ctl Limits	RPD	RPD Ctl Limits
SolubleOrganic Carbon	100	75 - 125	0.00	0 - 20

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: *Jeff Flauzenbaum*
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104114
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Case Narrative:DID NOT REC A METALS BOTTLE FOR TMW-2. ONLY RECD 3 AMBER VOAS.(CW 4-9-01) DO NOT LOG IN FOR METALS ANALYSIS AS PER MATT ERBE.(BJH 4-9-01) The TOC and SOC results have been reanalyzed and confirmed. See attached case narrative.

MICROSEEPS

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Page: Page 1 of 17
Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Sample Identification

Lab Sample #	Client Sample ID
P0104139-01	SMW-15
P0104139-02	SMW-17
P0104139-03	SMW-DUP
P0104139-04	SMW-12
P0104139-05	SMW-07
P0104139-06	SMW-2A
P0104139-07	SMW-2A-D
P0104139-08	TMW-6
P0104139-09	TMW-5
P0104139-10	TMW-4
P0104139-11	SMW-14

Approved By: Rebecca J. Stevens

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-01

Sample Description	Matrix	Sampled Date/Time	Received
SMW-15	Vapor	03 Apr. 01 11:05	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	70	0.60	mg/L	AM20GAX
Ethane	< 5.0	5.0	ng/L	
Ethene	< 5.0	5.0	ng/L	
Hydrogen	1.0	0.030	nM	
Methane	0.04	0.02	ug/L	
Nitrogen	15	0.40	mg/L	
Oxygen	6.5	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-02

Sample Description	Matrix	Sampled Date/Time	Received
SMW-17	Vapor	03 Apr. 01 15:40	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	20	0.60	mg/L	AM20GAX
Ethane	710	5.0	ng/L	
Ethene	2300	5.0	ng/L	
Hydrogen	4.7	0.030	nM	
Methane	160	0.02	ug/L	
Nitrogen	16	0.40	mg/L	
Oxygen	5.6	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-03

Sample Description	Matrix	Sampled Date/Time	Received
SMW-DUP	Vapor	03 Apr. 01 8:00	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	58	0.60	mg/L	AM20GAX
Ethane	< 5.0	5.0	ng/L	
Ethene	<5.0	5.0	ng/L	
Hydrogen	1.1	0.030	nM	
Methane	0.04	0.02	ug/L	
Nitrogen	15	0.40	mg/L	
Oxygen	6.1	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-04

Sample Description	Matrix	Sampled Date/Time	Received
SMW-12	Vapor	04 Apr. 01 9:46	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	19	0.60	mg/L	AM20GAX
Ethane	950	5.0	ng/L	
Ethene	1300	5.0	ng/L	
Hydrogen	0.69	0.030	nM	
Methane	9.4	0.02	ug/L	
Nitrogen	16	0.40	mg/L	
Oxygen	5.6	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
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Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-05

Sample Description	Matrix	Sampled Date/Time	Received
SMW-07	Vapor	04 Apr. 01 15:05	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	38	0.60	mg/L	AM20GAX
Ethane	460000	5.0	ng/L	
Ethene	210000	5.0	ng/L	
Hydrogen	1.4	0.030	nM	
Methane	2400	0.02	ug/L	
Nitrogen	14	0.40	mg/L	
Oxygen	3.7	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-06

Sample Description	Matrix	Sampled Date/Time	Received
SMW-2A	Vapor	05 Apr. 01 8:55	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	17	0.60	mg/L	AM20GAX
Ethane	210	5.0	ng/L	
Ethene	53	5.0	ng/L	
Hydrogen	2.5	0.030	nM	
Methane	0.14	0.02	ug/L	
Nitrogen	15	0.40	mg/L	
Oxygen	7.1	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-07

Sample Description	Matrix	Sampled Date/Time	Received
SMW-2A-D	Vapor	05 Apr. 01 8:55	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Hydrogen	2.3	0.030	nM	AM20GAX

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-08

Sample Description	Matrix	Sampled Date/Time	Received
TMW-6	Vapor	05 Apr. 01 13:30	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	76	0.60	mg/L	AM20GAX
Ethane	250000	5.0	ng/L	
Ethene	710	5.0	ng/L	
Hydrogen	330	0.030	nM	
Methane	5600	0.02	ug/L	
Nitrogen	11	0.40	mg/L	
Oxygen	3.6	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-09

Sample Description	Matrix	Sampled Date/Time	Received
TMW-5	Vapor	05 Apr. 01 15:15	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	64	0.60	mg/L	AM20GAX
Ethane	87000	5.0	ng/L	
Ethene	1100000	5.0	ng/L	
Hydrogen	29	0.030	nM	
Methane	900	0.02	ug/L	
Nitrogen	14	0.40	mg/L	
Oxygen	4.5	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-10

Sample Description	Matrix	Sampled Date/Time	Received
TMW-4	Vapor	06 Apr. 01 16:45	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	< 0.60	0.60	mg/L	AM20GAX
Ethane	<5.0	5.0	ng/L	
Ethene	< 5.0	5.0	ng/L	
Hydrogen	1.6	0.030	nM	
Methane	0.09	0.02	ug/L	
Nitrogen	17	0.40	mg/L	
Oxygen	0.24	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Lab Sample #: P0104139-11

Sample Description	Matrix	Sampled Date/Time	Received
SMW-14	Vapor	06 Apr. 01 18:00	09 Apr. 01

Analyte(s)	Result	PQL	Units	Method #
RiskAnalysis				
Carbon dioxide	13	0.60	mg/L	AM20GAX
Ethane	< 5.0	5.0	ng/L	
Ethene	< 5.0	5.0	ng/L	
Hydrogen	1.7	0.030	nM	
Methane	0.04	0.02	ug/L	
Nitrogen	15	0.40	mg/L	
Oxygen	7.4	0.15	mg/L	

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Hydrogen by Bubble Strip
Analysis Method: Hydrogen by Bubble Strip

M010416002-MB

	Result	RDL	%Recovery	Ctl Limits
Hydrogen	< 0.030	0.030		- NA

M010416002-LCS

	%Recovery	Ctl Limits
Hydrogen	96	0 - 0

[ ] Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Light Hydrocarbons by Bubble Strip/GC-FID/TCD/RGL
Analysis Method: Light Hydrocarbons by Bubble Strip/GC-FID/TCD/RGL

M010416003-MB

	Result	RDL	%Recovery	Ctl Limits
Ethane	< 5.0	5.0		- NA
Ethene	< 5.0	5.0		- NA

M010416003-LCS

	%Recovery	Ctl Limits
Ethane	100	0 - 0
Ethene	109	0 - 0

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Methane by Bubble Strip/ GC-FID/TCD/RGD
Analysis Method: Methane by Bubble Strip/ GC-FID/TCD/RGD

M010416004-MB

	Result	RDL	%Recovery	Ctl Limits
Methane	< 0.02	0.02		- NA

M010416004-LCS

	%Recovery	Ctl Limits
Methane	106	0 - 0

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Prep Method: Permanent Gases by Bubble Strip
Analysis Method: Permanent Gases by Bubble Strip

M010416005-MB

	Result	RDL	%Recovery	Ctl Limits
Carbon dioxide	< 0.60	0.60		- NA
Oxygen	< 0.15	0.15		- NA
Nitrogen	< 0.40	0.40		- NA

M010416005-LCS

	%Recovery	Ctl Limits
Carbon dioxide	90	0 - 0
Oxygen	100	0 - 0

Outlined Results indicate results outside of Control limits

Client Name: ERM, Inc
Contact: Jeff Flauzenbaum
Address: 2666 Riva Road
Suite200

Annapolis, MD 21401

Lab Project #: P0104139
Report Date: 05/09/01
Client Proj Name: MD Sand & Gravel
Client project #: 48410.01

Case Narrative:

SEVERN TRENT SERVICES

STL North Canton
4101 Shuffel Drive NW
North Canton, OH 44720-6961

Tel: 330 497 9396
Fax: 330 497 0772
www.stl-inc.com

SDG NARRATIVE

SDG 1D07124

This narrative pertains to samples received from the ERM MD Sand Gravel & Stone site. This data package, completed by STL North Canton consists of data from the volatile analyses of seventeen (17) water samples and one (1) quality control sample analyzed using the CLP OLC02.1 protocol.

Sample(s) that contained concentrations of target analyte(s) at a reportable level in the associated Method Blank(s) were flagged with "B". All target analytes in the Method Blank must be below the reporting limit (RL) or the associated sample(s) must be ND with the exception of common laboratory contaminants.

Sample(s) that contain results between the MDL and the RL were flagged with "J". There is the possibility of false positive or mis-identification at these quantitation levels. In analytical methods requiring confirmation of the analyte reported, confirmation was performed only down to the standard reporting limit (SRL). The acceptance criteria for QC samples may not be met at these quantitation levels.

The samples were received at the laboratory at a temperature of 4.2° C.

The following is a listing of the samples in SDG 1D07124:

Client ID	Laboratory ID	Sample Receipt Date
SMW-15	EAJ2H	04/07/01
SMW-13	EAJ2J	04/07/01
SMW-14	EAJ2K	04/07/01
SMW-17	EAJ2L	04/07/01
SMW-18A	EAJ2N	04/07/01
SMW-12	EAJ2P	04/07/01
SMW-19A	EAJ2Q	04/07/01

Table Of Contents

SDG NARRATIVE (continued)

The following is a listing of the samples in SDG 1D07124 (continued):

SMW-07	EAJ2R	04/07/01
SMW-2A	EAJ2T	04/07/01
SMW-DUP	EAJ2V	04/07/01
TRIP BLANK	EAJ2W	04/07/01
TMW-1	EAJ2X	04/07/01
TMW-2	EAJ20	04/07/01
TMW-3	EAJ21	04/07/01
TMW-4	EAJ22	04/07/01
TMW-5	EAJ23	04/07/01
TMW-6	EAJ26	04/07/01
HLDBLK	EAJ27	04/07/01

The following is a listing of the pH value for each volatile water sample as received by the laboratory:

Sample ID	pH
SMW-15	1.0
SMW-13	1.0
SMW-14	1.0
SMW-17	1.0
SMW-18A	1.0
SMW-12	1.0
SMW-19A	1.0
SMW-07	1.0
SMW-2A	1.0
SMW-DUP	1.0

SDG NARRATIVE (continued)

The following is a listing of the pH value for each volatile water sample as received by the laboratory (continued):

TRIP BLANK	1.0
TMW-1	1.0
TMW-2	1.0
TMW-3	1.0
TMW-4	1.0
TMW-5	1.0
TMW-6	1.0

There were no problems encountered during the preparation and analyses of the samples in this SDG.

Jeffrey C. Smith
Project Manager
April 26, 2001

SHIPPING AND RECEIVING DOCUMENTS

Chain of Custody Record

TRENT SERVICES **Severn Trent Laboratories, Inc**

STL-4124 (0700)

Client	Project Manager	Date	Chain of Custody Number
ERM, Inc. / Clean Sites, Inc.	Jeff Flanzenbaum		029705
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page** 1 of 2
2666 RIVA RD STE 200	(410) 266-0006 / 266-8912		
City / **State** / **Zip Code**	**Site Contact**	**Lab Contact**	
ANNAPOLIS / MD / 21401		Jeff Smith	
Project Name and Location (State)	**Carrier/Waybill Number**		
MD SAND GRAVEL & STONE ELKTON, MD			
Contract/Purchase Order/Quote No.			
040830			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis (Attach list if more space is needed): VOCs by CLP	Special Instructions/ Conditions of Receipt
SMW-15	4/3/01	1105		X						3			✓	
SMW-13	4/5/01	1735		X						3			✓	
SMW-14	4/6/01	1800		X						3			✓	
SMW-17	4/3/01	1540		X						3			✓	
SMW-18A	4/4/01	1166		X						3			✓	
SMW-12	4/4/01	0840		X						3			✓	
SMW-19A	4/4/01	1255		X						3			✓	
SMW-07	4/4/01	1505		X						3			✓	
SMW-2A	4/5/01	0855		X						3			✓	
SMW-DUP	4/3/01	0800		X						3			✓	
Trip Blank	4/3/01	0800		X						1			✓	
													SMW 4/6/01	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☒ Archive For Up to 3 Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☒ 14 Days ☐ 21 Days ☐ Other

QC Requirements (Specify)
CLP Data Package / Methods

1. Relinquished By	Date	Time	1. Received By	Date	Time
Martha Fiske	4/6/01	1630		4-7-01	0915
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

TRENT SERVICES — Severn Trent Laboratories, Inc

STL-4124 (0700)

Client: ERM, Inc. / Clean Sites, Inc.	Project Manager: Jeff Flanzenbaum	Date:	Chain of Custody Number: 029704
Address: 2666 River Road Ste 200	Telephone Number (Area Code)/Fax Number: (410) 266-0006 / 266-8912	Lab Number:	Page 2 of 2
City: Annapolis / State: MD / Zip Code: 21401	Site Contact:	Lab Contact: Jeff Smith	
Project Name and Location (State): MD Sand Gravel & Stone Elkton, MD	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.: 040830			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: VOC's by CLP	Special Instructions/ Conditions of Receipt
TMW-1	4/6/01	1025		X						3	2		✓	
TMW-2	4/6/01	1235		X						3	2		✓	
TMW-3	4/6/01	1420		X						3			✓	
TMW-4	4/6/01	1645		X						3			✓	
TMW-5	4/5/01	1515		X						3			✓	
TMW-6	4/5/01	1330		X						3			✓	
TMW-7	4/2/01													

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☒ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☒ Archive For Up to 3 Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☒ 14 Days ☐ 21 Days ☐ Other

QC Requirements (Specify): CLP data Package / Methods

	Date	Time		Date	Time
1. Relinquished By	4/6/01	1830	1. Received By	4-7-01	0915
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

DISTRIBUTION: WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 009
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2T1AA Date Extracted:04/10/01
Dilution factor: 3.33 Date Analyzed: 04/10/01
Moisture %:
QC Batch: 1101378

Client Sample Id: SMW-2A

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	3.3	U
74-83-9	Bromomethane	3.3	U
75-01-4	Vinyl chloride	1.9	J
75-00-3	Chloroethane	3.3	U
75-09-2	Methylene chloride	0.77	J
67-64-1	Acetone	5.7	J B
75-15-0	Carbon disulfide	3.3	U
75-35-4	1,1-Dichloroethene	1.2	J
75-34-3	1,1-Dichloroethane	12	
540-59-0	1,2-Dichloroethene (total)	50	
67-66-3	Chloroform	0.55	J
107-06-2	1,2-Dichloroethane	3.2	J
78-93-3	2-Butanone	17	U
71-55-6	1,1,1-Trichloroethane	18	
56-23-5	Carbon tetrachloride	3.3	U
75-27-4	Bromodichloromethane	3.3	U
78-87-5	1,2-Dichloropropane	3.3	U
10061-01-5	cis-1,3-Dichloropropene	3.3	U
79-01-6	Trichloroethene	27	
124-48-1	Dibromochloromethane	3.3	U
79-00-5	1,1,2-Trichloroethane	3.3	U
71-43-2	Benzene	3.3	U
10061-02-6	trans-1,3-Dichloropropene	3.3	U
75-25-2	Bromoform	3.3	U
108-10-1	4-Methyl-2-pentanone	3.3	U
591-78-6	2-Hexanone	17	U
127-18-4	Tetrachloroethene	26	
79-34-5	1,1,2,2-Tetrachloroethane	3.3	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 009
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2T1AA Date Extracted:04/10/01
Dilution factor: 3.33 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-2A

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	3.3	U
108-90-7	Chlorobenzene	0.92	J
100-41-4	Ethylbenzene	3.3	U
100-42-5	Styrene	3.3	U
1330-20-7	Xylenes (total)	3.3	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 008
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2R1AA Date Extracted:04/11/01
Dilution factor: 500 Date Analyzed: 04/11/01
Moisture %:
QC Batch: 1101378

Client Sample Id: SMW-07

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	500	U
74-83-9	Bromomethane	500	U
75-01-4	Vinyl chloride	500	U
75-00-3	**Chloroethane**	**1500**	
75-09-2	Methylene chloride	1000	U
67-64-1	Acetone	2500	U
75-15-0	Carbon disulfide	500	U
75-35-4	1,1-Dichloroethene	500	U
75-34-3	1,1-Dichloroethane	500	U
540-59-0	1,2-Dichloroethene (total)	500	U
67-66-3	Chloroform	500	U
107-06-2	1,2-Dichloroethane	500	U
78-93-3	2-Butanone	2500	U
71-55-6	1,1,1-Trichloroethane	500	U
56-23-5	Carbon tetrachloride	500	U
75-27-4	Bromodichloromethane	500	U
78-87-5	1,2-Dichloropropane	500	U
10061-01-5	cis-1,3-Dichloropropene	500	U
79-01-6	Trichloroethene	500	U
124-48-1	Dibromochloromethane	500	U
79-00-5	1,1,2-Trichloroethane	500	U
71-43-2	**Benzene**	**450**	**J**
10061-02-6	trans-1,3-Dichloropropene	500	U
75-25-2	Bromoform	500	U
108-10-1	4-Methyl-2-pentanone	500	U
591-78-6	2-Hexanone	2500	U
127-18-4	Tetrachloroethene	500	U
79-34-5	1,1,2,2-Tetrachloroethane	500	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 008
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2R1AA Date Extracted:04/11/01
Dilution factor: 500 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-07

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	6700	
108-90-7	Chlorobenzene	8600	
100-41-4	Ethylbenzene	400	J
100-42-5	Styrene	500	U
1330-20-7	Xylenes (total)	1700	

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 006
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2P1AA Date Extracted:04/10/01
Dilution factor: 5 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-12

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	5.0	U
74-83-9	Bromomethane	5.0	U
75-01-4	Vinyl chloride	13	
75-00-3	Chloroethane	2.9	J
75-09-2	Methylene chloride	10	U
67-64-1	Acetone	10	J B
75-15-0	Carbon disulfide	5.0	U
75-35-4	1,1-Dichloroethene	2.7	J
75-34-3	1,1-Dichloroethane	70	
540-59-0	1,2-Dichloroethene (total)	38	
67-66-3	Chloroform	2.0	J
107-06-2	1,2-Dichloroethane	5.0	U
78-93-3	2-Butanone	25	U
71-55-6	1,1,1-Trichloroethane	84	
56-23-5	Carbon tetrachloride	5.0	U
75-27-4	Bromodichloromethane	5.0	U
78-87-5	1,2-Dichloropropane	5.0	U
10061-01-5	cis-1,3-Dichloropropene	5.0	U
79-01-6	Trichloroethene	22	
124-48-1	Dibromochloromethane	5.0	U
79-00-5	1,1,2-Trichloroethane	5.0	U
71-43-2	Benzene	0.94	J
10061-02-6	trans-1,3-Dichloropropene	5.0	U
75-25-2	Bromoform	5.0	U
108-10-1	4-Methyl-2-pentanone	5.0	U
591-78-6	2-Hexanone	25	U
127-18-4	Tetrachloroethene	56	
79-34-5	1,1,2,2-Tetrachloroethane	5.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 006
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2P1AA Date Extracted:04/10/01
Dilution factor: 5 Date Analyzed: 04/10/01
Moisture %:
QC Batch: 1101378
Client Sample Id: SMW-12

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.4	J
108-90-7	Chlorobenzene	25	
100-41-4	Ethylbenzene	0.56	J
100-42-5	Styrene	5.0	U
1330-20-7	Xylenes (total)	1.4	J

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 002
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2J1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: SMW-13

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	**Methylene chloride**	**0.38**	**J**
67-64-1	**Acetone**	**2.1**	**J**
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 002
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2J1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: SMW-13

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	0.13	J
108-90-7	Chlorobenzene	0.40	J
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	0.15	J

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 003
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2K1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: SMW-14

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	**Methylene chloride**	**0.30**	**J**
67-64-1	Acetone	5.0	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	**Chloroform**	**0.31**	**J B**
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 003
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2K1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: SMW-14

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 001
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2H1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-15

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	**Methylene chloride**	**0.30**	**J**
67-64-1	Acetone	5.0	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	**Chloroform**	**2.2**	
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	**Tetrachloroethene**	**0.11**	**J**
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 001
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2H1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-15

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	0.15	J
108-90-7	Chlorobenzene	0.18	J
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 004
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2L1AA Date Extracted:04/10/01
Dilution factor: 16.67 Date Analyzed: 04/10/01
Moisture %:
QC Batch: 1101378

Client Sample Id: SMW-17

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	17	U
74-83-9	Bromomethane	17	U
75-01-4	Vinyl chloride	9.6	J
75-00-3	Chloroethane	5.5	J
75-09-2	Methylene chloride	33	U
67-64-1	Acetone	83	U
75-15-0	Carbon disulfide	17	U
75-35-4	1,1-Dichloroethene	2.5	J
75-34-3	1,1-Dichloroethane	180	
540-59-0	1,2-Dichloroethene (total)	22	
67-66-3	Chloroform	7.0	J
107-06-2	1,2-Dichloroethane	12	J
78-93-3	2-Butanone	83	U
71-55-6	1,1,1-Trichloroethane	360	
56-23-5	Carbon tetrachloride	17	U
75-27-4	Bromodichloromethane	17	U
78-87-5	1,2-Dichloropropane	17	U
10061-01-5	cis-1,3-Dichloropropene	17	U
79-01-6	Trichloroethene	45	
124-48-1	Dibromochloromethane	17	U
79-00-5	1,1,2-Trichloroethane	5.2	J
71-43-2	Benzene	17	U
10061-02-6	trans-1,3-Dichloropropene	17	U
75-25-2	Bromoform	17	U
108-10-1	4-Methyl-2-pentanone	17	U
591-78-6	2-Hexanone	83	U
127-18-4	Tetrachloroethene	5.5	J
79-34-5	1,1,2,2-Tetrachloroethane	17	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 004
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: KAJ2L1AA Date Extracted:04/10/01
Dilution factor: 16.67 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-17

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	83	
108-90-7	Chlorobenzene	10	J
100-41-4	Ethylbenzene	25	
100-42-5	Styrene	17	U
1330-20-7	Xylenes (total)	93	

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 005
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2N1AA Date Extracted:04/10/01
Dilution factor: 16.67 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-18A

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	17	U
74-83-9	Bromomethane	17	U
75-01-4	Vinyl chloride	17	U
75-00-3	Chloroethane	17	U
75-09-2	Methylene chloride	33	U
67-64-1	Acetone	22	J B
75-15-0	Carbon disulfide	17	U
75-35-4	1,1-Dichloroethene	3.7	J
75-34-3	1,1-Dichloroethane	60	
540-59-0	1,2-Dichloroethene (total)	8.1	J
67-66-3	Chloroform	3.7	J
107-06-2	1,2-Dichloroethane	3.8	J
78-93-3	2-Butanone	83	U
71-55-6	1,1,1-Trichloroethane	260	
56-23-5	Carbon tetrachloride	17	U
75-27-4	Bromodichloromethane	17	U
78-87-5	1,2-Dichloropropane	17	U
10061-01-5	cis-1,3-Dichloropropene	17	U
79-01-6	Trichloroethene	27	
124-48-1	Dibromochloromethane	17	U
79-00-5	1,1,2-Trichloroethane	17	U
71-43-2	Benzene	17	U
10061-02-6	trans-1,3-Dichloropropene	17	U
75-25-2	Bromoform	17	U
108-10-1	4-Methyl-2-pentanone	17	U
591-78-6	2-Hexanone	83	U
127-18-4	Tetrachloroethene	7.8	J
79-34-5	1,1,2,2-Tetrachloroethane	17	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 005
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2N1AA Date Extracted:04/10/01
Dilution factor: 16.67 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-18A

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	17	U
108-90-7	Chlorobenzene	5.1	J
100-41-4	Ethylbenzene	17	U
100-42-5	Styrene	17	U
1330-20-7	Xylenes (total)	17	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 007
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2Q1AA Date Extracted:04/10/01
Dilution factor: 10 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-19A

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	28	
75-00-3	Chloroethane	26	
75-09-2	Methylene chloride	7.0	J
67-64-1	Acetone	50	U
75-15-0	Carbon disulfide	10	U
75-35-4	1,1-Dichloroethene	2.4	J
75-34-3	1,1-Dichloroethane	140	
540-59-0	1,2-Dichloroethene (total)	58	
67-66-3	Chloroform	3.7	J
107-06-2	1,2-Dichloroethane	2.5	J
78-93-3	2-Butanone	50	U
71-55-6	1,1,1-Trichloroethane	150	
56-23-5	Carbon tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	20	
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	4.4	J
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	50	U
127-18-4	Tetrachloroethene	87	
79-34-5	1,1,2,2-Tetrachloroethane	10	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 007
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2Q1AA Date Extracted:04/10/01
Dilution factor: 10 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: SMW-19A

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	5.5	J
108-90-7	Chlorobenzene	38	
100-41-4	Ethylbenzene	3.6	J
100-42-5	Styrene	10	U
1330-20-7	Xylenes (total)	4.0	J

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 010
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2V1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: SMW-DUP

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	**Methylene chloride**	**0.36**	**J**
67-64-1	Acetone	5.0	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	**Chloroform**	**2.1**	**B**
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	**Tetrachloroethene**	**0.11**	**J**
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 010
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2V1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: SMW-DUP

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WQ Lab Sample ID:A1D070124 011
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2W1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: TRIP BLANK

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	Methylene chloride	0.37	J
67-64-1	Acetone	5.0	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WQ Lab Sample ID:A1D070124 011
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2W1AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: TRIP BLANK

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 012
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: RAJ2X1AA Date Extracted:04/10/01
Dilution factor: 25 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: TMW-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	25	U
74-83-9	Bromomethane	25	U
75-01-4	Vinyl chloride	25	U
75-00-3	Chloroethane	25	U
75-09-2	Methylene chloride	270	
67-64-1	Acetone	170	B
75-15-0	Carbon disulfide	25	U
75-35-4	1,1-Dichloroethene	25	U
75-34-3	1,1-Dichloroethane	40	
540-59-0	1,2-Dichloroethene (total)	25	U
67-66-3	Chloroform	42	
107-06-2	1,2-Dichloroethane	25	U
78-93-3	2-Butanone	320	
71-55-6	1,1,1-Trichloroethane	460	
56-23-5	Carbon tetrachloride	25	U
75-27-4	Bromodichloromethane	25	U
78-87-5	1,2-Dichloropropane	25	U
10061-01-5	cis-1,3-Dichloropropene	25	U
79-01-6	Trichloroethene	29	
124-48-1	Dibromochloromethane	25	U
79-00-5	1,1,2-Trichloroethane	25	U
71-43-2	Benzene	15	J
10061-02-6	trans-1,3-Dichloropropene	25	U
75-25-2	Bromoform	25	U
108-10-1	4-Methyl-2-pentanone	560	
591-78-6	2-Hexanone	120	U
127-18-4	Tetrachloroethene	42	
79-34-5	1,1,2,2-Tetrachloroethane	25	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 012
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ2X1AA Date Extracted:04/10/01
Dilution factor: 25 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: TMW-1

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	190	
108-90-7	Chlorobenzene	170	
100-41-4	Ethylbenzene	5.9	J
100-42-5	Styrene	25	U
1330-20-7	Xylenes (total)	26	

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 013
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ201AA Date Extracted:04/10/01
Dilution factor: 16.67 Date Analyzed: 04/10/01
Moisture %:

QC Batch: 1101378

Client Sample Id: TMW-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	17	U
74-83-9	Bromomethane	17	U
75-01-4	Vinyl chloride	17	U
75-00-3	Chloroethane	17	U
75-09-2	Methylene chloride	45	
67-64-1	Acetone	37	J B
75-15-0	Carbon disulfide	17	U
75-35-4	1,1-Dichloroethene	3.5	J
75-34-3	1,1-Dichloroethane	7.1	J
540-59-0	1,2-Dichloroethene (total)	17	U
67-66-3	Chloroform	21	
107-06-2	1,2-Dichloroethane	17	U
78-93-3	2-Butanone	83	U
71-55-6	1,1,1-Trichloroethane	320	
56-23-5	Carbon tetrachloride	17	U
75-27-4	Bromodichloromethane	17	U
78-87-5	1,2-Dichloropropane	17	U
10061-01-5	cis-1,3-Dichloropropene	17	U
79-01-6	Trichloroethene	71	
124-48-1	Dibromochloromethane	17	U
79-00-5	1,1,2-Trichloroethane	17	U
71-43-2	Benzene	3.5	J
10061-02-6	trans-1,3-Dichloropropene	17	U
75-25-2	Bromoform	17	U
108-10-1	4-Methyl-2-pentanone	21	
591-78-6	2-Hexanone	83	U
127-18-4	Tetrachloroethene	58	
79-34-5	1,1,2,2-Tetrachloroethane	17	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 013
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ201AA Date Extracted:04/10/01
Dilution factor: 16.67 Date Analyzed: 04/10/01
Moisture %:
QC Batch: 1101378

Client Sample Id: TMW-2

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	49	
108-90-7	Chlorobenzene	58	
100-41-4	Ethylbenzene	3.5	J
100-42-5	Styrene	17	U
1330-20-7	Xylenes (total)	17	

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 014
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ211AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: TMW-3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	Methylene chloride	2.0	U
67-64-1	**Acetone**	**2.8**	**J**
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	**1,1,1-Trichloroethane**	**1.3**	
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	**Trichloroethene**	**0.24**	**J**
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	**Tetrachloroethene**	**0.42**	**J**
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 014
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ211AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: TMW-3

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	0.37	J
108-90-7	Chlorobenzene	0.44	J
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	0.13	J

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 015
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ221AA Date Extracted:04/11/01
Dilution factor: 10 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1101378

Client Sample Id: TMW-4

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	10	U
74-83-9	Bromomethane	10	U
75-01-4	Vinyl chloride	71	
75-00-3	Chloroethane	10	U
75-09-2	Methylene chloride	2.2	J
67-64-1	Acetone	16	J B
75-15-0	Carbon disulfide	10	U
75-35-4	1,1-Dichloroethene	5.5	J
75-34-3	1,1-Dichloroethane	26	
540-59-0	1,2-Dichloroethene (total)	17	
67-66-3	Chloroform	1.9	J
107-06-2	1,2-Dichloroethane	10	U
78-93-3	2-Butanone	50	U
71-55-6	1,1,1-Trichloroethane	130	
56-23-5	Carbon tetrachloride	10	U
75-27-4	Bromodichloromethane	10	U
78-87-5	1,2-Dichloropropane	10	U
10061-01-5	cis-1,3-Dichloropropene	10	U
79-01-6	Trichloroethene	37	
124-48-1	Dibromochloromethane	10	U
79-00-5	1,1,2-Trichloroethane	10	U
71-43-2	Benzene	1.3	J
10061-02-6	trans-1,3-Dichloropropene	10	U
75-25-2	Bromoform	10	U
108-10-1	4-Methyl-2-pentanone	10	U
591-78-6	2-Hexanone	50	U
127-18-4	Tetrachloroethene	130	
79-34-5	1,1,2,2-Tetrachloroethane	10	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 015
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ221AA Date Extracted:04/11/01
Dilution factor: 10 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1101378

Client Sample Id: TMW-4

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	2.2	J
108-90-7	Chlorobenzene	21	
100-41-4	Ethylbenzene	10	U
100-42-5	Styrene	10	U
1330-20-7	Xylenes (total)	1.3	J

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 016
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ231AA Date Extracted:04/11/01
Dilution factor: 1000 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: TMW-5

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1000	U
74-83-9	Bromomethane	1000	U
75-01-4	Vinyl chloride	1000	U
75-00-3	**Chloroethane**	**780**	**J**
75-09-2	Methylene chloride	2000	U
67-64-1	Acetone	5000	U
75-15-0	Carbon disulfide	1000	U
75-35-4	1,1-Dichloroethene	1000	U
75-34-3	**1,1-Dichloroethane**	**150**	**J**
540-59-0	1,2-Dichloroethene (total)	1000	U
67-66-3	**Chloroform**	**150**	**J B**
107-06-2	1,2-Dichloroethane	1000	U
78-93-3	2-Butanone	5000	U
71-55-6	1,1,1-Trichloroethane	1000	U
56-23-5	Carbon tetrachloride	1000	U
75-27-4	Bromodichloromethane	1000	U
78-87-5	1,2-Dichloropropane	1000	U
10061-01-5	cis-1,3-Dichloropropene	1000	U
79-01-6	Trichloroethene	1000	U
124-48-1	Dibromochloromethane	1000	U
79-00-5	1,1,2-Trichloroethane	1000	U
71-43-2	**Benzene**	**320**	**J**
10061-02-6	trans-1,3-Dichloropropene	1000	U
75-25-2	Bromoform	1000	U
108-10-1	4-Methyl-2-pentanone	1000	U
591-78-6	2-Hexanone	5000	U
127-18-4	Tetrachloroethene	1000	U
79-34-5	1,1,2,2-Tetrachloroethane	1000	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 016
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ231AA Date Extracted:04/11/01
Dilution factor: 1000 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: TMW-5

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	13000	
108-90-7	Chlorobenzene	5400	
100-41-4	Ethylbenzene	370	J
100-42-5	Styrene	1000	U
1330-20-7	Xylenes (total)	1700	

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 017
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ261AA Date Extracted:04/11/01
Dilution factor: 166.67 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1101378

Client Sample Id: TMW-6

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	170	U
74-83-9	Bromomethane	170	U
75-01-4	Vinyl chloride	170	U
75-00-3	**Chloroethane**	**240**	
75-09-2	Methylene chloride	330	U
67-64-1	Acetone	830	U
75-15-0	Carbon disulfide	170	U
75-35-4	1,1-Dichloroethene	170	U
75-34-3	1,1-Dichloroethane	170	U
540-59-0	1,2-Dichloroethene (total)	170	U
67-66-3	Chloroform	170	U
107-06-2	1,2-Dichloroethane	170	U
78-93-3	2-Butanone	830	U
71-55-6	1,1,1-Trichloroethane	170	U
56-23-5	Carbon tetrachloride	170	U
75-27-4	Bromodichloromethane	170	U
78-87-5	1,2-Dichloropropane	170	U
10061-01-5	cis-1,3-Dichloropropene	170	U
79-01-6	Trichloroethene	170	U
124-48-1	Dibromochloromethane	170	U
79-00-5	1,1,2-Trichloroethane	170	U
71-43-2	**Benzene**	**290**	
10061-02-6	trans-1,3-Dichloropropene	170	U
75-25-2	Bromoform	170	U
108-10-1	4-Methyl-2-pentanone	170	U
591-78-6	2-Hexanone	830	U
127-18-4	**Tetrachloroethene**	**19**	**J**
79-34-5	1,1,2,2-Tetrachloroethane	170	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WG Lab Sample ID:A1D070124 017
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ261AA Date Extracted:04/11/01
Dilution factor: 166.67 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1101378

Client Sample Id: TMW-6

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	77	J
108-90-7	Chlorobenzene	3700	
100-41-4	Ethylbenzene	45	J
100-42-5	Styrene	170	U
1330-20-7	Xylenes (total)	310	

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WQ Lab Sample ID:A1D070124 018
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: RAJ271AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: HLDBLK

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	Methylene chloride	0.26	J
67-64-1	Acetone	5.0	U
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1D07124

Matrix: (soil/water) WQ Lab Sample ID:A1D070124 018
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 04/07/01
Work Order: EAJ271AA Date Extracted:04/11/01
Dilution factor: 1 Date Analyzed: 04/11/01
Moisture %:

QC Batch: 1102435

Client Sample Id: HLDBLK

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

SEVERN TRENT SERVICES

SDG NARRATIVE

This narrative pertains to samples received from ERM from the MD Sand, Gravel & Stone Site, project number 48410.01. This data package, completed by STL North Canton, consists of data from the volatile analyses of five (5) water samples, two (2) waste samples and one (1) quality control sample analyzed using the CLP OLM02.1 protocols.

The following is a listing of the samples in SDG 1E25274:

Laboratory ID	Client ID	Sample Receipt Date
ED1NG	TMW-1S	05/25/01
ED1NR	TMW-2S	05/25/01
ED1NX	TMW-5S	05/25/01
ED1N0	TMW-6S	05/25/01
ED1PH	TMW-7S	05/25/01
ED1PL	TB-1(5/24/	05/25/01
ED1PR	HLDBLK	05/25/01

During sample receipt, the following anomalies occurred:

See STL's Cooler Receipt Form for additional information.

During the preparation and analyses of these samples, the following anomalies occurred:

GC/MS VOLATILES

Sample(s) that contained concentrations of target analyte(s) at a reportable level in the associated Method Blank(s) were flagged with "B". All target analytes in the Method Blank must be below the reporting limit (RL) or the associated sample(s) must be ND with the exception of common laboratory contaminants.

Sample(s) that contain results between the MDL and the RL were flagged with "J". There is the possibility of false positive or mis-identification at these quantitation levels. In analytical methods requiring confirmation of the analyte reported, confirmation was performed only down to the standard reporting limit (SRL). The acceptance criteria

Some samples had elevated reporting limits due to matrix interferences, TICs, or dilution.

Jeffrey C. Smith
Project Manager
June 7, 2001

SAMPLE DATA

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 2 / g Date Received: 05/25/01
Work Order: ED1NG1AA Date Extracted:05/30/01
Dilution factor: 20 Date Analyzed: 05/30/01

QC Batch: 1150502

Client Sample Id: TMW-1S
Soil Extract Vol: 10 / mL Soil Aliquot Vol: 2 / uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	24000	U
74-83-9	Bromomethane	24000	U
75-01-4	Vinyl chloride	24000	U
75-00-3	Chloroethane	24000	U
75-09-2	**Methylene chloride**	**140000**	
67-64-1	**Acetone**	**210000**	
75-15-0	Carbon disulfide	12000	U
75-35-4	**1,1-Dichloroethene**	**6200**	J
75-34-3	1,1-Dichloroethane	12000	U
540-59-0	1,2-Dichloroethene (total)	12000	U
67-66-3	**Chloroform**	**25000**	
107-06-2	1,2-Dichloroethane	12000	U
78-93-3	**2-Butanone**	**490000**	
71-55-6	**1,1,1-Trichloroethane**	**130000**	
56-23-5	Carbon tetrachloride	12000	U
75-27-4	Bromodichloromethane	12000	U
78-87-5	1,2-Dichloropropane	12000	U
10061-01-5	cis-1,3-Dichloropropene	12000	U
79-01-6	**Trichloroethene**	**20000**	
124-48-1	Dibromochloromethane	12000	U
79-00-5	1,1,2-Trichloroethane	12000	U
71-43-2	**Benzene**	**12000**	
10061-02-6	trans-1,3-Dichloropropene	12000	U
75-25-2	Bromoform	12000	U
108-10-1	**4-Methyl-2-pentanone**	**670000**	
591-78-6	2-Hexanone	50000	U
127-18-4	**Tetrachloroethene**	**26000**	
79-34-5	1,1,2,2-Tetrachloroethane	12000	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 2 / g Date Received: 05/25/01
Work Order: ED1NG1AA Date Extracted:05/30/01
Dilution factor: 20 Date Analyzed: 05/30/01

QC Batch: 1150502

Client Sample Id: TMW-1S
Soil Extract Vol: 10 / mL Soil Aliquot Vol: 2 / uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	160000	
108-90-7	Chlorobenzene	120000	
100-41-4	Ethylbenzene	12000	U
100-42-5	Styrene	12000	U
1330-20-7	Xylenes (total)	23000	

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 2.01 / g Date Received: 05/25/01
Work Order: ED1NG2AA Date Extracted:06/01/01
Dilution factor: 1990.05 Date Analyzed: 06/01/01

QC Batch: 1155456

Client Sample Id: TMW-1S -RE 1
Soil Extract Vol: 10 / mL Soil Aliquot Vol: 1 / uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	2400000	U
74-83-9	Bromomethane	2400000	U
75-01-4	Vinyl chloride	2400000	U
75-00-3	Chloroethane	2400000	U
75-09-2	**Methylene chloride**	**1600000**	
67-64-1	Acetone	5000000	U
75-15-0	Carbon disulfide	1200000	U
75-35-4	1,1-Dichloroethene	1200000	U
75-34-3	1,1-Dichloroethane	1200000	U
540-59-0	1,2-Dichloroethene (total)	1200000	U
67-66-3	**Chloroform**	**940000**	J
107-06-2	1,2-Dichloroethane	1200000	U
78-93-3	2-Butanone	5000000	U
71-55-6	**1,1,1-Trichloroethane**	**23000000**	
56-23-5	Carbon tetrachloride	1200000	U
75-27-4	Bromodichloromethane	1200000	U
78-87-5	1,2-Dichloropropane	1200000	U
10061-01-5	cis-1,3-Dichloropropene	1200000	U
79-01-6	**Trichloroethene**	**3700000**	
124-48-1	Dibromochloromethane	1200000	U
79-00-5	1,1,2-Trichloroethane	1200000	U
71-43-2	**Benzene**	**870000**	J
10061-02-6	trans-1,3-Dichloropropene	1200000	U
75-25-2	Bromoform	1200000	U
108-10-1	**4-Methyl-2-pentanone**	**5200000**	
591-78-6	2-Hexanone	5000000	U
127-18-4	**Tetrachloroethene**	**16000000**	
79-34-5	1,1,2,2-Tetrachloroethane	1200000	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 001
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 2.01 / g Date Received: 05/25/01
Work Order: ED1NG2AA Date Extracted:06/01/01
Dilution factor: 1990.05 Date Analyzed: 06/01/01

QC Batch: 1155456

Client Sample Id: TMW-1S -RE 1
Soil Extract Vol: 10 / mL Soil Aliquot Vol: 1 / uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	38000000	
108-90-7	Chlorobenzene	37000000	
100-41-4	Ethylbenzene	2100000	
100-42-5	Styrene	1200000	U
1330-20-7	Xylenes (total)	12000000	

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 002
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1NR1AA Date Extracted:05/30/01
Dilution factor: 6250 Date Analyzed: 05/30/01
Moisture %:

QC Batch: 1151299

Client Sample Id: TMW-2S

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	6200	U
74-83-9	Bromomethane	6200	U
75-01-4	Vinyl chloride	6200	U
75-00-3	Chloroethane	6200	U
75-09-2	**Methylene chloride**	**39000**	
67-64-1	**Acetone**	**18000**	**J B**
75-15-0	Carbon disulfide	6200	U
75-35-4	1,1-Dichloroethene	6200	U
75-34-3	1,1-Dichloroethane	6200	U
540-59-0	1,2-Dichloroethene (total)	6200	U
67-66-3	**Chloroform**	**17000**	**B**
107-06-2	1,2-Dichloroethane	6200	U
78-93-3	2-Butanone	31000	U
71-55-6	**1,1,1-Trichloroethane**	**76000**	
56-23-5	Carbon tetrachloride	6200	U
75-27-4	Bromodichloromethane	6200	U
78-87-5	1,2-Dichloropropane	6200	U
10061-01-5	cis-1,3-Dichloropropene	6200	U
79-01-6	**Trichloroethene**	**43000**	
124-48-1	Dibromochloromethane	6200	U
79-00-5	1,1,2-Trichloroethane	6200	U
71-43-2	Benzene	6200	U
10061-02-6	trans-1,3-Dichloropropene	6200	U
75-25-2	Bromoform	6200	U
108-10-1	**4-Methyl-2-pentanone**	**62000**	
591-78-6	2-Hexanone	31000	U
127-18-4	**Tetrachloroethene**	**17000**	
79-34-5	1,1,2,2-Tetrachloroethane	6200	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 002
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1NR1AA Date Extracted:05/30/01
Dilution factor: 6250 Date Analyzed: 05/30/01
Moisture %:

QC Batch: 1151299

Client Sample Id: TMW-2S

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	120000	
108-90-7	Chlorobenzene	57000	
100-41-4	Ethylbenzene	6200	U
100-42-5	Styrene	6200	U
1330-20-7	Xylenes (total)	23000	

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 003
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1NX1AA Date Extracted:05/31/01
Dilution factor: 4166.67 Date Analyzed: 05/31/01
Moisture %:

QC Batch: 1151299

Client Sample Id: TMW-5S

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	4200	U
74-83-9	Bromomethane	4200	U
75-01-4	Vinyl chloride	4200	U
75-00-3	Chloroethane	4200	U
75-09-2	Methylene chloride	29000	
67-64-1	Acetone	7300	J B
75-15-0	Carbon disulfide	4200	U
75-35-4	1,1-Dichloroethene	4200	U
75-34-3	1,1-Dichloroethane	670	J
540-59-0	1,2-Dichloroethene (total)	600	J
67-66-3	Chloroform	2100	J B
107-06-2	1,2-Dichloroethane	4200	U
78-93-3	2-Butanone	21000	U
71-55-6	1,1,1-Trichloroethane	32000	
56-23-5	Carbon tetrachloride	4200	U
75-27-4	Bromodichloromethane	720	J B
78-87-5	1,2-Dichloropropane	4200	U
10061-01-5	cis-1,3-Dichloropropene	4200	U
79-01-6	Trichloroethene	18000	
124-48-1	Dibromochloromethane	4200	U
79-00-5	1,1,2-Trichloroethane	4200	U
71-43-2	Benzene	1700	J
10061-02-6	trans-1,3-Dichloropropene	4200	U
75-25-2	Bromoform	4200	U
108-10-1	4-Methyl-2-pentanone	26000	
591-78-6	2-Hexanone	21000	U
127-18-4	Tetrachloroethene	7700	
79-34-5	1,1,2,2-Tetrachloroethane	4200	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 003
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1NX1AA Date Extracted:05/31/01
Dilution factor: 4166.67 Date Analyzed: 05/31/01
Moisture %:

QC Batch: 1151299

Client Sample Id: TMW-5S

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	63000	
108-90-7	Chlorobenzene	12000	
100-41-4	Ethylbenzene	1000	J
100-42-5	Styrene	4200	U
1330-20-7	Xylenes (total)	5000	

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 004
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 2.01 / g Date Received: 05/25/01
Work Order: ED1N02AA Date Extracted:06/01/01
Dilution factor: 99.5 Date Analyzed: 06/01/01

QC Batch: 1155456

Client Sample Id: TMW-6S -RE 1
Soil Extract Vol: 10 / mL Soil Aliquot Vol: 2 / uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
74-87-3	Chloromethane	120000	U
74-83-9	Bromomethane	120000	U
75-01-4	Vinyl chloride	120000	U
75-00-3	Chloroethane	120000	U
75-09-2	**Methylene chloride**	**170000**	
67-64-1	**Acetone**	**91000**	**J**
75-15-0	Carbon disulfide	62000	U
75-35-4	1,1-Dichloroethene	62000	U
75-34-3	1,1-Dichloroethane	62000	U
540-59-0	1,2-Dichloroethene (total)	62000	U
67-66-3	Chloroform	62000	U
107-06-2	1,2-Dichloroethane	62000	U
78-93-3	2-Butanone	250000	U
71-55-6	**1,1,1-Trichloroethane**	**510000**	
56-23-5	Carbon tetrachloride	62000	U
75-27-4	Bromodichloromethane	62000	U
78-87-5	1,2-Dichloropropane	62000	U
10061-01-5	cis-1,3-Dichloropropene	62000	U
79-01-6	**Trichloroethene**	**180000**	
124-48-1	Dibromochloromethane	62000	U
79-00-5	1,1,2-Trichloroethane	62000	U
71-43-2	Benzene	62000	U
10061-02-6	trans-1,3-Dichloropropene	62000	U
75-25-2	Bromoform	62000	U
108-10-1	**4-Methyl-2-pentanone**	**360000**	
591-78-6	2-Hexanone	250000	U
127-18-4	**Tetrachloroethene**	**240000**	
79-34-5	1,1,2,2-Tetrachloroethane	62000	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 004
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 2.01 / g Date Received: 05/25/01
Work Order: ED1N02AA Date Extracted:06/01/01
Dilution factor: 99.5 Date Analyzed: 06/01/01

QC Batch: 1155456

Client Sample Id: TMW-6S -RE 1
Soil Extract Vol: 10 / mL Soil Aliquot Vol: 2 / uL

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/kg	Q
108-88-3	Toluene	430000	
108-90-7	Chlorobenzene	360000	
100-41-4	Ethylbenzene	40000	J
100-42-5	Styrene	62000	U
1330-20-7	Xylenes (total)	230000	

ERM

TENTATIVELY IDENTIFIED COMPOUNDS

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 004
Method: SW846 8260B
Volatile Organics, GC/MS (8260B)

Sample WT/Vol: 2.01 / g Date Received: 05/25/01
Work Order: ED1N02AA Date Extracted:06/01/01
Dilution factor: 99.5 Date Analyzed: 06/01/01

QC Batch: 1155456

Client Sample Id: TMW-6S -RE 1
Soil Extract Vol: 10 / mL Soil Aliquot Vol: 2 / uL

		(ug/L or ug/kg) ug/kg		
CAS NUMBER	COMPOUND NAME	RT	EST. CONC.	Q
106-46-7	1,4-Dichlorobenzene	9.863	130000	
95-50-1	1,2-Dichlorobenzene	10.23	67000	
120-82-1	1,2,4-Trichlorobenzene	11.827	1900000	
87-61-6	1,2,3-Trichlorobenzene	12.312	380000	

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 005
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1PH1AA Date Extracted:05/31/01
Dilution factor: 12500 Date Analyzed: 05/31/01
Moisture %:

QC Batch: 1151299

Client Sample Id: TMW-7S

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	12000	U
74-83-9	Bromomethane	12000	U
75-01-4	Vinyl chloride	12000	U
75-00-3	Chloroethane	12000	U
75-09-2	Methylene chloride	43000	
67-64-1	Acetone	34000	J B
75-15-0	Carbon disulfide	12000	U
75-35-4	1,1-Dichloroethene	12000	U
75-34-3	1,1-Dichloroethane	12000	U
540-59-0	1,2-Dichloroethene (total)	12000	U
67-66-3	Chloroform	19000	B
107-06-2	1,2-Dichloroethane	12000	U
78-93-3	2-Butanone	62000	U
71-55-6	1,1,1-Trichloroethane	74000	
56-23-5	Carbon tetrachloride	12000	U
75-27-4	Bromodichloromethane	12000	U
78-87-5	1,2-Dichloropropane	12000	U
10061-01-5	cis-1,3-Dichloropropene	12000	U
79-01-6	Trichloroethene	42000	
124-48-1	Dibromochloromethane	12000	U
79-00-5	1,1,2-Trichloroethane	12000	U
71-43-2	Benzene	12000	U
10061-02-6	trans-1,3-Dichloropropene	12000	U
75-25-2	Bromoform	12000	U
108-10-1	4-Methyl-2-pentanone	61000	
591-78-6	2-Hexanone	62000	U
127-18-4	Tetrachloroethene	17000	
79-34-5	1,1,2,2-Tetrachloroethane	12000	U

ERM

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 005
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1PH1AA Date Extracted:05/31/01
Dilution factor: 12500 Date Analyzed: 05/31/01
Moisture %:

QC Batch: 1151299

Client Sample Id: TMW-7S

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	120000	
108-90-7	Chlorobenzene	57000	
100-41-4	Ethylbenzene	12000	U
100-42-5	Styrene	12000	U
1330-20-7	Xylenes (total)	22000	

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 008
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1PR1AA Date Extracted:05/30/01
Dilution factor: 1 Date Analyzed: 05/30/01
Moisture %:

QC Batch: 1151299

Client Sample Id: *HLDBLK*

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
74-87-3	Chloromethane	1.0	U
74-83-9	Bromomethane	1.0	U
75-01-4	Vinyl chloride	1.0	U
75-00-3	Chloroethane	1.0	U
75-09-2	Methylene chloride	2.0	U
67-64-1	**Acetone**	**2.2**	**J B**
75-15-0	Carbon disulfide	1.0	U
75-35-4	1,1-Dichloroethene	1.0	U
75-34-3	1,1-Dichloroethane	1.0	U
540-59-0	1,2-Dichloroethene (total)	1.0	U
67-66-3	Chloroform	1.0	U
107-06-2	1,2-Dichloroethane	1.0	U
78-93-3	2-Butanone	5.0	U
71-55-6	1,1,1-Trichloroethane	1.0	U
56-23-5	Carbon tetrachloride	1.0	U
75-27-4	Bromodichloromethane	1.0	U
78-87-5	1,2-Dichloropropane	1.0	U
10061-01-5	cis-1,3-Dichloropropene	1.0	U
79-01-6	Trichloroethene	1.0	U
124-48-1	Dibromochloromethane	1.0	U
79-00-5	1,1,2-Trichloroethane	1.0	U
71-43-2	Benzene	1.0	U
10061-02-6	trans-1,3-Dichloropropene	1.0	U
75-25-2	Bromoform	1.0	U
108-10-1	4-Methyl-2-pentanone	1.0	U
591-78-6	2-Hexanone	5.0	U
127-18-4	Tetrachloroethene	1.0	U
79-34-5	1,1,2,2-Tetrachloroethane	1.0	U

Lab Name:Severn Trent Laboratories, Inc. SDG Number:1E25274

Matrix: (soil/water) WG Lab Sample ID:A1E250274 008
Method: OCLP OLC02.1
Volatile Organics, GC/MS (CLP-Low Level)

Sample WT/Vol: 25 / mL Date Received: 05/25/01
Work Order: ED1PR1AA Date Extracted:05/30/01
Dilution factor: 1 Date Analyzed: 05/30/01
Moisture %:

QC Batch: 1151299

Client Sample Id: HLDBLK

CAS NO.	COMPOUND	CONCENTRATION UNITS: (ug/L or ug/kg) ug/L	Q
108-88-3	Toluene	1.0	U
108-90-7	Chlorobenzene	1.0	U
100-41-4	Ethylbenzene	1.0	U
100-42-5	Styrene	1.0	U
1330-20-7	Xylenes (total)	1.0	U

C

Appendix C
BIOCHLOR Model Results

BIOCHLOR Natural Attenuation Decision Support System

Version 2.0

MD Sand Gravel & Stone
Elkton, MD
Rate Constant Calculations

Data Input Instructions:

115 → 1. Enter value directly....or
↑ or 2. Calculate by filling in gray
0.02 cells. Press Enter, then (C)
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes ○ Ethanes ◉

1. ADVECTION

Seepage Velocity*	Vs	28.5	(ft/yr)
or			
Hydraulic Conductivity	K	9.0E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.36	(-)

2. DISPERSION

Alpha x*	19.811	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-05	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.67	(kg/L)	
FractionOrganicCarbon, foc	2.5E-4	(-)	
Partition Coefficient	Koc		
TCA	151	(L/kg)	1.18 (-)
DCA	30	(L/kg)	1.04 (-)
CA	3	(L/kg)	1.00 (-)
			1.00
			1.00
Common R (used in model)* =			1.04

4. BIOTRANSFORMATION

-1st Order Decay Coefficient*

	λ (1/yr)	half-life (yrs)	Yield
Zone 1			
TCA → DCA	0.425	1.63	0.74
DCA → CA	0.729	0.95	0.65
CA → Ethane	3.465	0.20	0.47
	0.000		0.00
Zone 2	λ (1/yr)	half-life (yrs)	
TCA → DCA	0.000		
DCA → CA	0.000		
CA → Ethane	0.000		
	0.000		

λ HELP

5. GENERAL

Simulation Time*	32	(yr)
Modeled Area Width*	225	(ft)
Modeled Area Length*	410	(ft)
Zone 1 Length*	410	(ft)
Zone 2 Length*	0	(ft)

L, W

Zone 2= L - Zone 1

6. SOURCE DATA

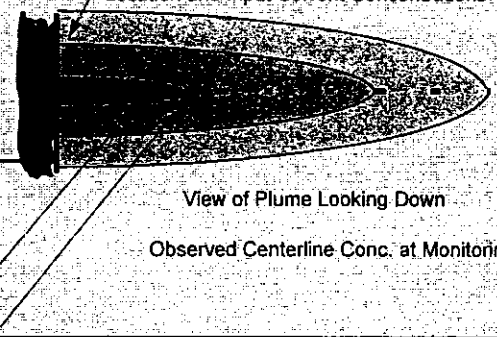
TYPE: Continuous Single Planar

Source Options

Source Thickness in Sat. Zone* 1 (ft)

	Y1	k_s* (1/yr)
Width* (ft)	30	
Conc. (mg/L)*	C1	
TCA	74.0	0
DCA	.0	0
CA	.0	0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

TCA Conc. (mg/L)	74.0							.150	.084	.130	.260
DCA Conc. (mg/L)	.0							.140	.070	.026	.600
CA Conc. (mg/L)	.0							.026	.003	.000	.000
Dist. from Source (ft)	0							410	467	507	547

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore Formulas | RESET | *SEE OUTPUT* | Paste Example

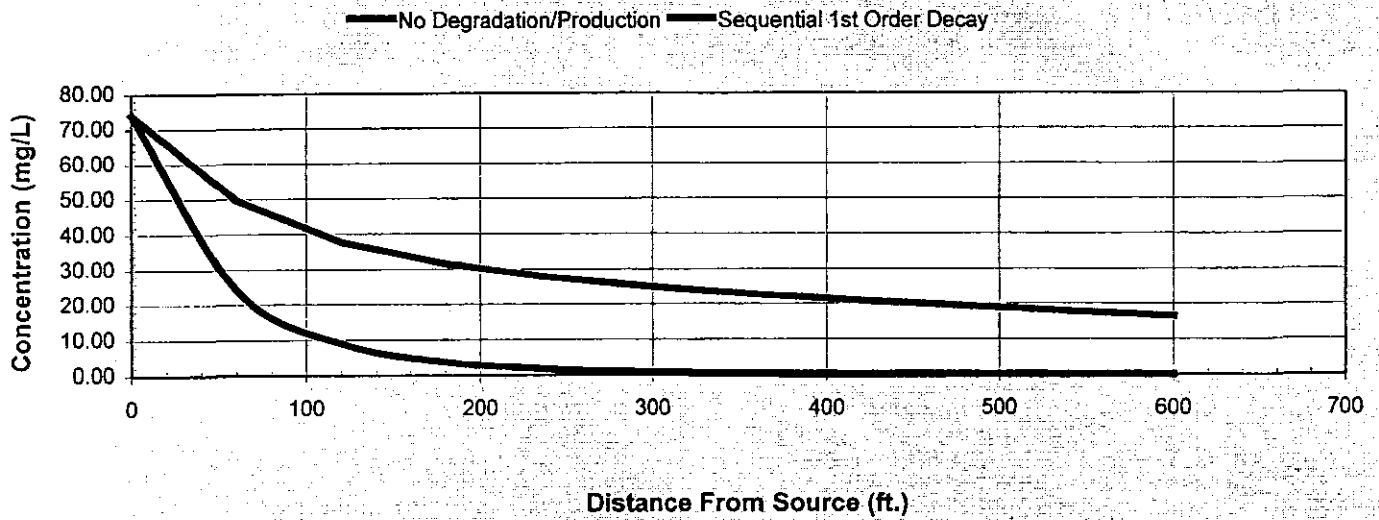
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

TCA	0	60	120	180	240	300	360	420	480	540	600
No Degradation	74.000	49.534	37.628	31.493	27.591	24.796	22.629	20.841	19.271	17.791	16.278
Biotransformation	74.000	24.023	8.850	3.593	1.527	0.666	0.295	0.132	0.060	0.027	0.012

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	74.000							0.150	0.084	0.130	0.260



See TCA

See DCA

See CA

Prepare Animation

Time:

32.0 Years

Log ⟺ inear

Return to Input

To All

To Array

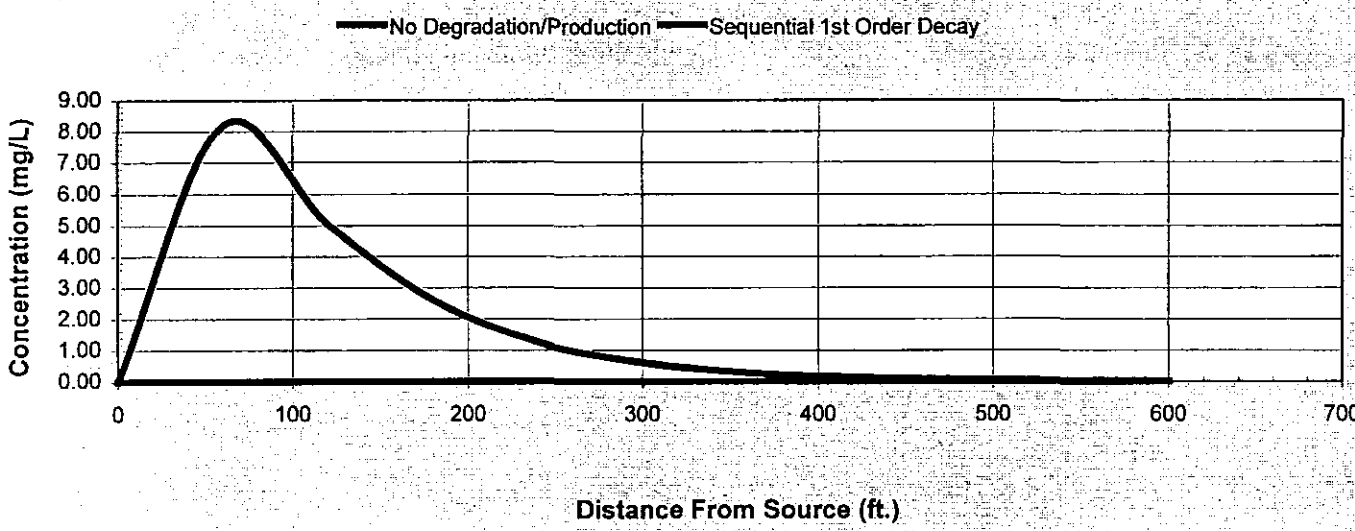
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

DCA	0	60	120	180	240	300	360	420	480	540	600
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.000	8.187	5.040	2.597	1.261	0.596	0.278	0.128	0.059	0.027	0.013

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	0.000							0.140	0.070	0.026	0.600



See TCA

See DCA

See CA

Prepare Animation

Time:

32.0 Years

Log ⟺ inear

Return to Input

To All

To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

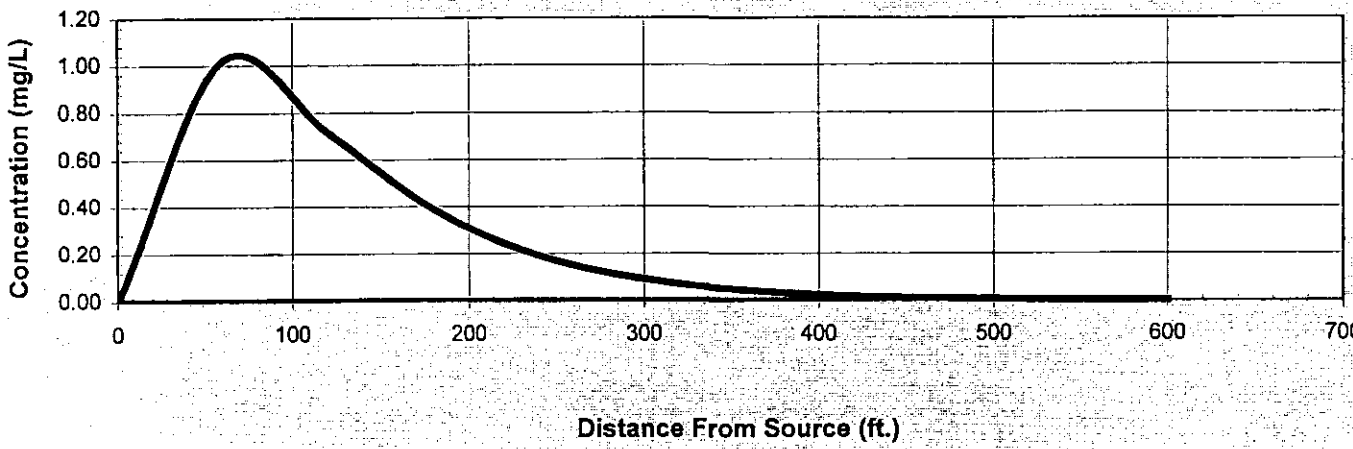
Distance from Source (ft)

CA	0	60	120	180	240	300	360	420	480	540	600
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.000	1.019	0.717	0.387	0.192	0.092	0.043	0.020	0.009	0.004	0.002

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	0.000							0.026	0.003	0.000	0.000

No Degradation/Production Sequential 1st Order Decay



See TCA

See DCA

See CA

Prepare Animation

Time:

32.0 Years

Log ⟺ inear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.0

MD Sand Gravel & Stone
Elkton, MD
Rate Constant Calculations

Data Input Instructions:

115 → 1. Enter value directly....or
↑ or ↗ 2. Calculate by filling in gray
0.02 cells. Press Enter, then (C)
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Methylene Chloride (◉) Ethanes (○)

1. ADVECTION

Seepage Velocity*	Vs	28.5	(ft/yr)
or			
Hydraulic Conductivity	K	9.0E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.36	(-)

2. DISPERSION

Alpha x*	19.811	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-05	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R

or

Soil Bulk Density, rho	1.67	(kg/L)		
FractionOrganicCarbon, foc	2.5E-4	(-)		
Partition Coefficient	Koc			
Methylene Chloride	9	(L/kg)	1.01	(-)
		(L/kg)		(-)
		(L/kg)		(-)
		(L/kg)		(-)
		(L/kg)		(-)
Common R (used in model)* =			1.01	

4. BIOTRANSFORMATION -1st Order Decay Coefficient*

Zone 1 (Methylene Chloride)

λ (1/yr)	half-life (yrs)	Yield
0.693	1.00	0.79
0.000		0.74
0.000		0.64
0.000		0.45

Zone 2

λ (1/yr)	half-life (yrs)
0.000	
0.000	
0.000	
0.000	

λ HELP

5. GENERAL

Simulation Time*	32	(yr)	← L →
Modeled Area Width*	225	(ft)	W
Modeled Area Length*	600	(ft)	
Zone 1 Length*	600	(ft)	
Zone 2 Length*	0	(ft)	Zone 2= L - Zone 1

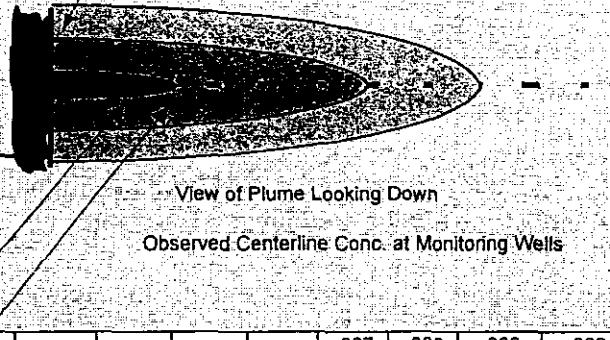
6. SOURCE DATA TYPE: Continuous / Single Planar

Source Options

Source Thickness in Sat. Zone* 1 (ft)

	Y1	k_s* (1/yr)
Width* (ft)	30	
Conc. (mg/L)*	C1	
Methylene Chloride	43.0	0
		0
		0
		0
		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

MC Conc. (mg/L)	43.0						.007	.000	.002	.000
Dist. from Source (ft)	0						410	467	507	547

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | Help | Restore Formulas | RESET | SEE OUTPUT | Paste Example

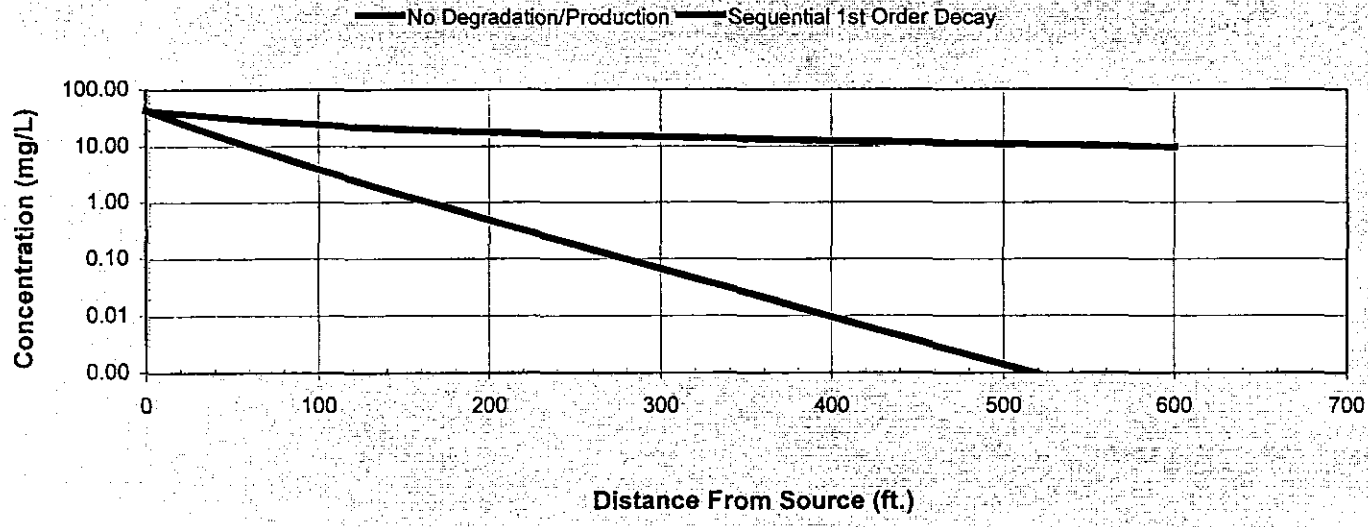
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

Methylene Chloride	0	60	120	180	240	300	360	420	480	540	600
No Degradation	43.000	28.783	21.865	18.300	16.033	14.410	13.154	12.122	11.224	10.391	9.562
Biotransformation	43.000	9.796	2.533	0.721	0.215	0.066	0.020	0.006	0.002	0.001	0.000

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	43.000							0.007	0.000	0.002	0.000



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

32.0 Years

Log ⟺ inear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.0

MD Sand Gravel & Stone
Elkton, MD
Rate Constant Calculations

Data Input Instructions:

115 → 1. Enter value directly....or
↑ or 0.02 ↗ 2. Calculate by filling in gray cells. Press Enter, then (C)
(To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

Test if Biotransformation *is Occurring* → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Chlorobenzene (◉) Ethanes (○)

1. ADVECTION

Seepage Velocity*	Vs	28.5	(ft/yr)
or			
Hydraulic Conductivity	K	9.0E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.36	(-)

2. DISPERSION

Alpha x*	19.811	(ft)
(Alpha y) / (Alpha x)*	0.1	(-)
(Alpha z) / (Alpha x)*	1.E-05	(-)

Calc. Alpha x

3. ADSORPTION

Retardation Factor* → R
or
Soil Bulk Density, rho: 1.67 (kg/L)
FractionOrganicCarbon, foc: 2.5E-4 (-)

Partition Coefficient Koc			
Chlorobenzene	331	(L/kg)	1.39 (-)
	47	(L/kg)	1.06 (-)
		(L/kg)	(-)
		(L/kg)	(-)
		(L/kg)	(-)

Common R (used in model)* = 1.22

4. BIOTRANSFORMATION

-1st Order Decay Coefficient*

	λ (1/yr)	half-life (yrs)	Yield
Zone 1 Chlorobenzene	0.513	1.35	0.79
	0.000		0.74
	0.000		0.64
	0.000		0.45
Zone 2	λ (1/yr)	half-life (yrs)	
	0.000		
	0.000		
	0.000		
	0.000		

λ HELP

5. GENERAL

Simulation Time*	32	(yr)
Modeled Area Width*	225	(ft)
Modeled Area Length*	410	(ft)
Zone 1 Length*	410	(ft)
Zone 2 Length*	0	(ft)

Zone 2= L - Zone 1

6. SOURCE DATA TYPE: Continuous / Single Planar

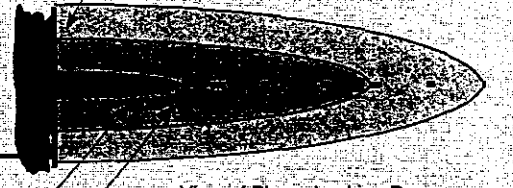
Source Options

Source Thickness in Sat. Zone* 1 (ft)

Width* (ft) Y1: 30

Conc. (mg/L)*	C1	k_s* (1/yr)
Chlorobenzene	57.0	0
		0
		0
		0
		0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

CB Conc. (mg/L)	57.0							.025	.038	.021	.005
Dist. from Source (ft)	0							410	467	507	547

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore Formulas | RESET | *SEE OUTPUT* | Paste Example

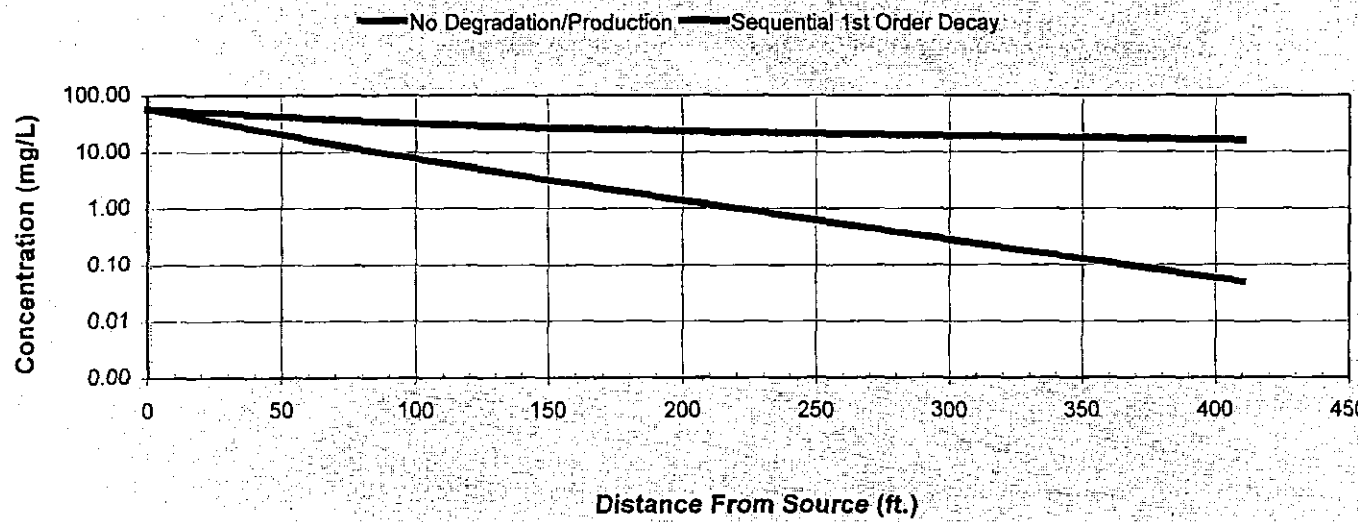
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

Chlorobenzene	0	41	82	123	164	205	246	287	328	369	410
No Degradation	57.000	43.363	33.897	28.679	25.289	22.858	20.992	19.484	18.210	17.087	16.051
Biotransformation	57.000	24.323	10.665	5.062	2.504	1.270	0.654	0.341	0.179	0.095	0.050

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	57.000							0.025	0.038	0.021	0.005



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

32.0 Years

Log ⟺ inear

Return to Input

To All

To Array

BIOCHLOR Natural Attenuation Decision Support System

Version 2.0

MD Sand Gravel & Stone
Elkton, MD
Rate Constant Calculations

Data Input Instructions:
115 → 1. Enter value directly....or
↑ or ↗ 2. Calculate by filling in gray
0.02 cells. Press Enter, then (C)
(To restore formulas, hit "Restore Formulas" button.)
Variable* → Data used directly in model.

Test if Biotransformation is Occurring → Natural Attenuation Screening Protocol

TYPE OF CHLORINATED SOLVENT: Ethenes (◉) Ethanes (○)

1. ADVECTION

Seepage Velocity*	Vs	28.5	(ft/yr)
or			
Hydraulic Conductivity	K	9.0E-04	(cm/sec)
Hydraulic Gradient	i	0.011	(ft/ft)
Effective Porosity	n	0.36	(-)

2. DISPERSION

Alpha x*	19.811	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	1.E-05	(-)	

3. ADSORPTION

*Retardation Factor** → R

or

			R
Soil Bulk Density, rho	1.67	(kg/L)	
FractionOrganicCarbon, foc	2.5E-4	(-)	
Partition Coefficient	Koc		
PCE	209	(L/kg)	1.25 (-)
TCE	87	(L/kg)	1.10 (-)
DCE	49	(L/kg)	1.06 (-)
VC	3	(L/kg)	1.00 (-)
ETH	320	(L/kg)	1.38 (-)
Common R (used in model)* =			1.10

4. BIOTRANSFORMATION

	-1st Order Decay Coefficient* λ (1/yr)		half-life (yrs)	Yield
Zone 1				
PCE → TCE	0.315	←	2.20	0.79
TCE → DCE	0.578	←	1.20	0.74
DCE → VC	1.260	←	0.55	0.64
VC → ETH	1.873	←	0.37	0.45
Zone 2	λ (1/yr)		half-life (yrs)	
PCE → TCE	0.000	←		λ HELP
TCE → DCE	0.000	←		
DCE → VC	0.000	←		
VC → ETH	0.000	←		

5. GENERAL

Simulation Time*	32	(yr)	← L →
Modeled Area Width*	225	(ft)	W ↓
Modeled Area Length*	600	(ft)	
Zone 1 Length*	600	(ft)	
Zone 2 Length*	0	(ft)	Zone 2= L - Zone 1

6. SOURCE DATA

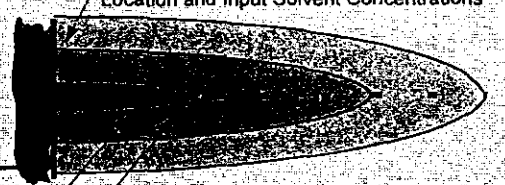
TYPE: Continuous / Single Planar

Source Options

Source Thickness in Sat. Zone* 1 (ft)

	Y1	k_s* (1/yr)
Width* (ft)	30	
Conc. (mg/L)*	C1	
PCE	17.0	0
TCE	43.0	0
DCE	.0	0
VC	.0	0
ETH	.0	0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



View of Plume Looking Down

Observed Centerline Conc. at Monitoring Wells

7. FIELD DATA FOR COMPARISON

PCE Conc. (mg/L)	17.0							.087	.056	.130	.008
TCE Conc. (mg/L)	43.0							.020	.022	.037	.027
DCE Conc. (mg/L)	.0							.058	.038	.017	.008
VC Conc. (mg/L)	0.0							.028	.013	.071	.000
ETH Conc. (mg/L)	0.0							.063	.001	.000	.000
Dist. from Source (ft)	0							410	467	507	547

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE | RUN ARRAY | *Help* | Restore Formulas | RESET | *SEE OUTPUT* | Paste Example

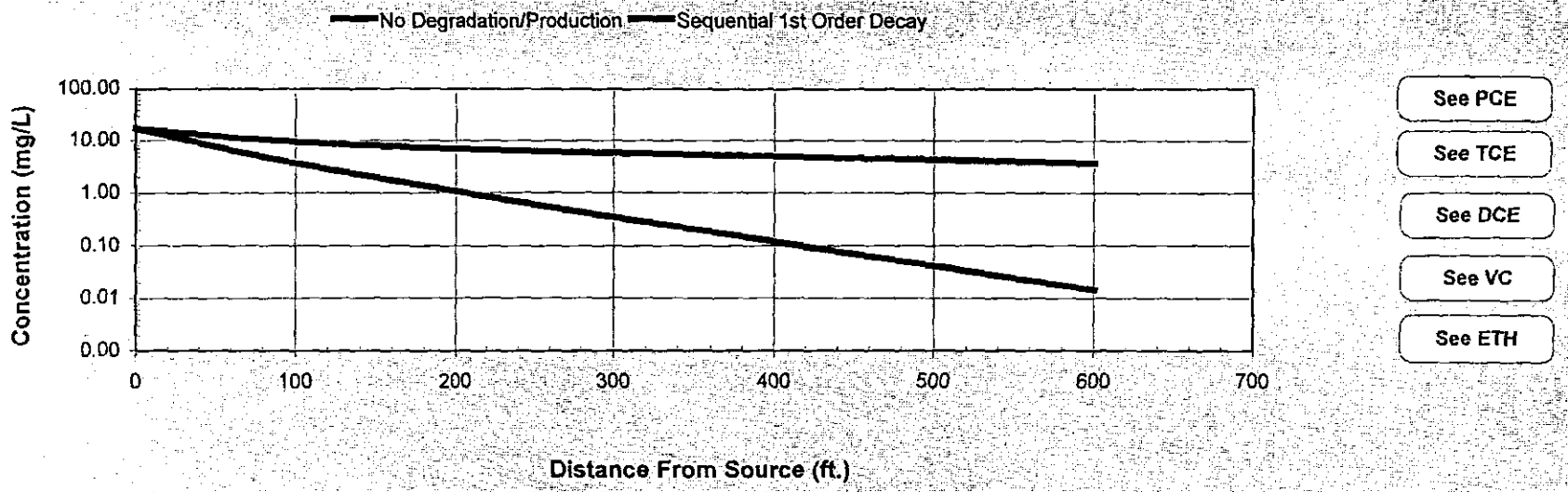
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

PCE	0	60	120	180	240	300	360	420	480	540	600
No Degradation	17.000	11.379	8.644	7.235	6.338	5.694	5.192	4.770	4.389	4.014	3.616
Biotransformation	17.000	6.497	2.818	1.346	0.673	0.346	0.180	0.095	0.050	0.027	0.014

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	17.000							0.087	0.056	0.130	0.008



See PCE | See TCE | See DCE | See VC | See ETH

Prepare Animation

Time: 32.0 Years

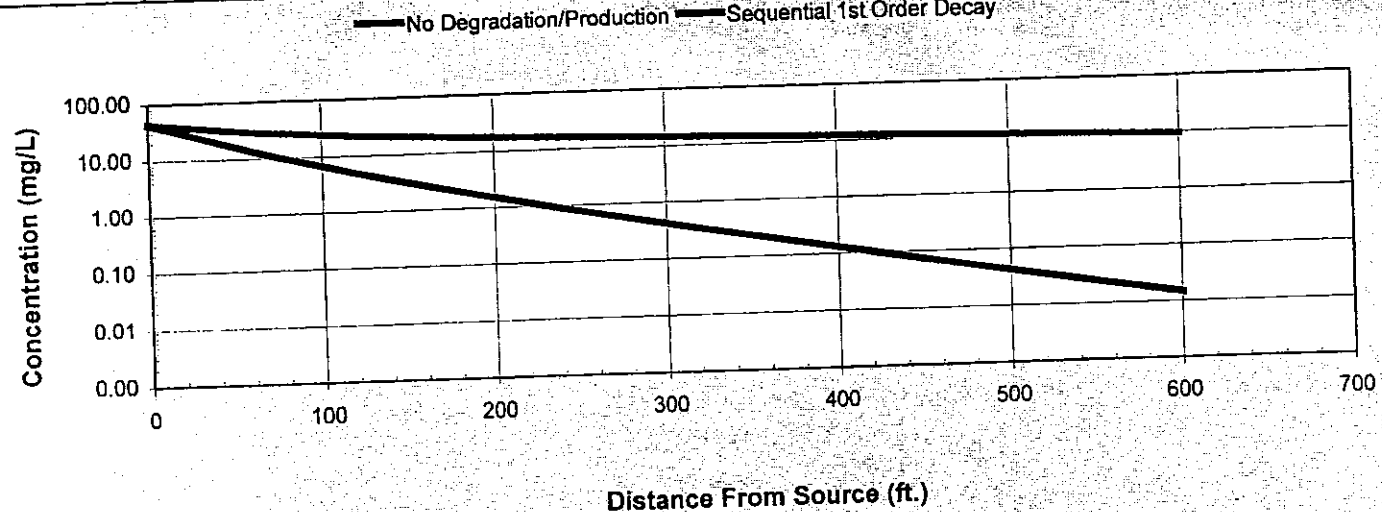
Log ⟺ inear

Return to Input | To All | To Array

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)										
	0	60	120	180	240	300	360	420	480	540	600
No Degradation	43.000	28.783	21.865	18.299	16.030	14.402	13.132	12.066	11.102	10.154	9.147
Biotransformation	43.000	13.261	4.802	1.981	0.883	0.415	0.203	0.102	0.052	0.027	0.014

	Monitoring Well Locations (ft)										
	0							410	467	506.66	547
Field Data from Site	43.000							0.020	0.022	0.037	0.027



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

32.0 Years

Log ⟺ inear

Return to Input

To All

To Array

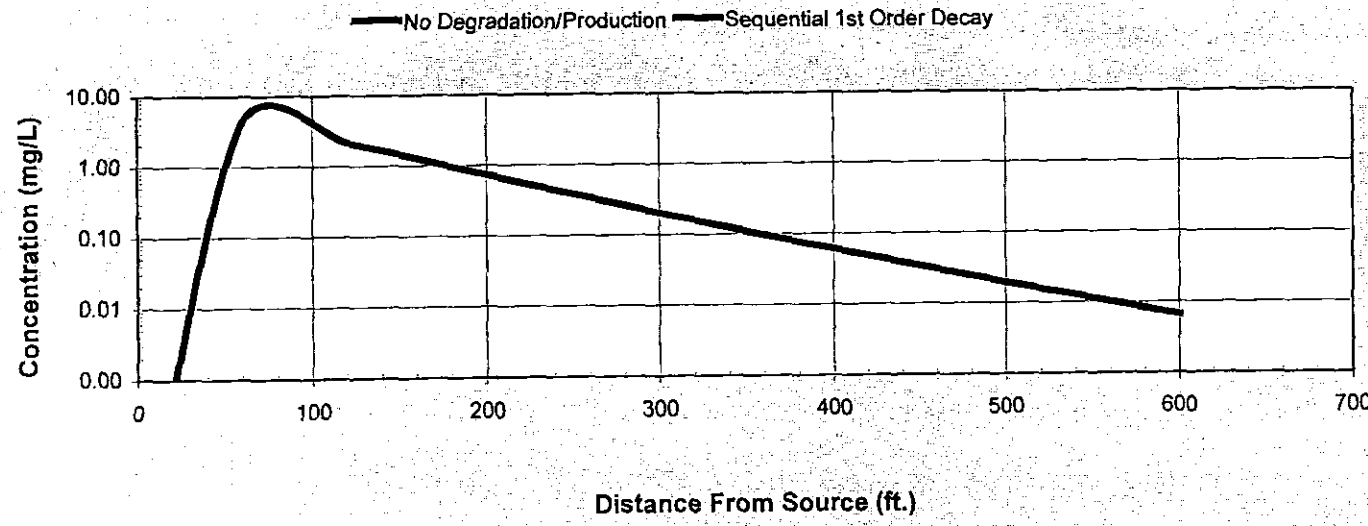
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

DCE	0	60	120	180	240	300	360	420	480	540	600
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.000	4.267	2.124	0.952	0.430	0.200	0.096	0.048	0.024	0.013	0.007

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	0.000							0.058	0.038	0.017	0.008



See PCE

See TCE

See DCE

See VC

See ETH

Time:

32.0 Years

Log ⟷ inear

Prepare Animation

Return to Input

To All

To Array

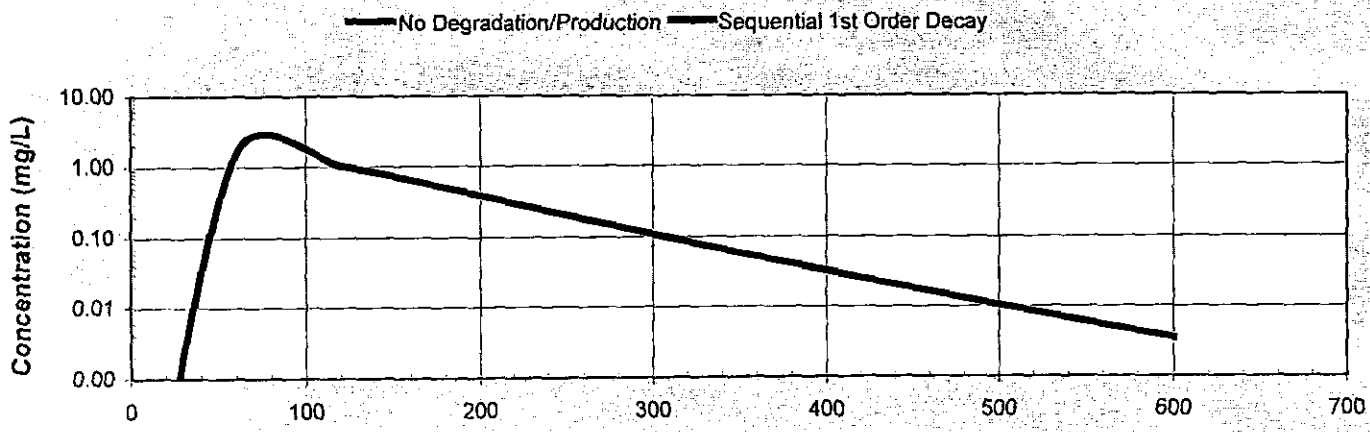
DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

Distance from Source (ft)

VC	0	60	120	180	240	300	360	420	480	540	600
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.000	1.557	1.017	0.501	0.233	0.109	0.052	0.026	0.013	0.007	0.003

Monitoring Well Locations (ft)

	0							410	467	506.66	547
Field Data from Site	0.000							0.028	0.013	0.071	0.000



See PCE

See TCE

See DCE

See VC

See ETH

Prepare Animation

Time:

32.0 Years

Log ⟺ inear

Return to Input

To All

To Array